DRAFT REPORT

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SCREENING-LEVEL RISK ASSESSMENT

OMAHA SHOPS

Prepared for

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TABLE OF CONTENTS

Section				Page
EXECUTIVE SUMMARY				ES-1
1.0	INTRODUCTION AND PURPOSE			1-1
2.0	METHODOLOGY			2-1
	2.1	COMPARISON TO RISK-BASED CONCENTRATIONS		2-1
	2.2	DERIVATION OF RBCs		2-2
		2.2.1	Receptors and Exposure Pathways	2-3
		2.2.2	Risk-Based Concentration Equations	2-3
		2.2.3	Reference Doses and Slope Factors	2-5
		2.2.4	Target Hazard Index for Noncarcinogens and Target Risk for Carcinogens	2-5
		2.2.5	Exposure Parameters and Assumptions	2-6
		2.2.6	Air Inhalation Assumptions	2-7
		2.2.7	Soil Ingestion Assumptions	2-7
		2.2.8	Soil Contact Rate	2-7
		2.2.9	Air Emissions	2-8
			2.2.9.1 Volatilization of VOCs from Soils	2-8
			2.2.9.2 Particulate Emissions from Soils	2-10
	2.3	COMPARISON OF SITE METALS CONCENTRATIONS WITH BACKGROUND		2-12
	2.4	SAMPLING AND ANALYSIS		2-13
3.0	OPERATIONAL AREA INVESTIGATIONS			3-1
	3.1	OIL STORAGE		3-1
	3.2	ROUNDHOUSE		3-2
	3.3	WASTEWATER TREATMENT/BABBITT SHOP		3-3
	3.4	GAS HOUSE		3-4
	3.5	STORES AREA (EAST AND WEST)		3-5
	3.6	TRACTION MOTOR SHOP		3-6
	3.7	BLUE BUILDING		3-7
	3.8	NEW TRANSFORMER STORAGE AREA		3-8
	3.9	CHEMICAL STORAGE BUILDING		3-8
	3.10	OLD TRACTION MOTOR SHOP		3-9

Section		Page
3.11	ACETYLENE PIT	3-9
3.12	OIL TANKS/PUMP HOUSE	3-10
3.13	BEARING SHOP	3-11
3.14	WHEEL SHOP	3-12
3.15	POWER HOUSE	3-12
3.16	OIL AND WASTE HOUSE	3-13
3.17	FUEL STORAGE AREA	3-14
3.18	TEMPORARY HAZARDOUS WASTE STORAGE AREA	3-14
3.19	CAR DISMANTLE AREA (EAST AND WEST)	3-15
3.20	OLD TRANSFORMER STORAGE AREA	3-16
3.21	PAINT BARREL PITS	3-16
3.22	CAR SHOP	3-17
3.23	STEEL SHOP	3-18
3.24	CAR HOLDING AREA	3-19
3.25	CAR DEMOLISH AREA	3-20
3.26	OPEN DRUM STORAGE AREA (NORTH AND SOUTH)	3-20
3.27	EIGHTH STREET YARD (SOUTH, CENTRAL, AND NORTH SECTIONS)	3-22
3.28	GRACE STREET YARD	3-24
3.29	GRACE STREET TANK	3-24
3.30	OIL PIPELINE	3-25
3.31	CONSTRUCTION AREA	3-25
4.0	SUMMARY AND CONCLUSIONS	4-1
5.0	REFERENCES	5-1

LIST OF TABLES

TABLE 2-1	CONSTANTS FOR RBC CALCULATIONS
TABLE 2-2a	RBC CALCULATIONS FOR THE CONSTRUCTION WORKER SCENARIO - CARCINOGENIC
TABLE 2-2b	RBC CALCULATIONS FOR THE CONSTRUCTION WORKER SCENARIO - NONCARCINOGENIC
TABLE 2-3a	RBC CALCULATIONS FOR THE OCCUPATIONAL WORKER SCENARIO - CARCINOGENIC
TABLE 2-3b	RBC CALCULATIONS FOR THE OCCUPATIONAL WORKER SCENARIO - NONCARCINOGENIC
TABLE 2-4a	RBC CALCULATIONS FOR THE RECREATIONAL USER SCENARIO - CARCINOGENIC
TABLE 2-4b	RBC CALCULATIONS FOR THE RECREATIONAL USER SCENARIO - NONCARCINOGENIC
TABLE 2-5	REFERENCE DOSES FOR NONCARCINOGENIC CHEMICALS OF CONCERN
TABLE 2-6	SLOPE FACTORS FOR CARCINOGENIC CHEMICALS OF CONCERN
TABLE 2-7	BACKGROUND CONCENTRATIONS FOR METALS IN SOILS IN OMAHA
TABLE 2-8	COMPARISON OF SITE METALS CONCENTRATIONS WITH BACKGROUND LEVELS
TABLE 3-1	COMPARISON OF SITE CONCENTRATIONS AT THE OIL STORAGE AREA TO RBCs
TABLE 3-2	COMPARISON OF SITE CONCENTRATIONS AT THE ROUNDHOUSE TO RBCs
TABLE 3-3	COMPARISON OF SITE CONCENTRATIONS AT THE BABBITT SHOP AREA TO RBCs
TABLE 3-4	COMPARISON OF SITE CONCENTRATIONS AT THE WASTEWATER TREATMENT AREA TO RBCs
TABLE 3-5	COMPARISON OF SITE CONCENTRATIONS AT THE GAS HOUSE TO RBCs
TABLE 3-6	COMPARISON OF SITE CONCENTRATIONS AT THE EAST SECTION OF THE STORES AREA TO RBCs
TABLE 3-7	COMPARISON OF SITE CONCENTRATIONS AT THE WEST SECTION OF THE STORES AREA TO RBCs
TABLE 3-8	COMPARISON OF SITE CONCENTRATIONS AT THE TRACTION MOTOR SHOP TO RBCs

LIST OF TABLES

TABLE 3-9	COMPARISON OF SITE CONCENTRATIONS AT THE BLUE BUILDING TO RBCs
TABLE 3-10	COMPARISON OF SITE CONCENTRATIONS AT THE SOIL STORAGE TANK AREA TO RBCs
TABLE 3-11	COMPARISON OF SITE CONCENTRATIONS AT THE CHEMICAL STORAGE BUILDING TO RBCs
TABLE 3-12	COMPARISON OF SITE CONCENTRATIONS AT THE ACETYLENE PITS TO RBCs
TABLE 3-13	COMPARISON OF SITE CONCENTRATIONS AT THE OIL TANKS/PUMP HOUSE AREA TO RBCs
TABLE 3-14	COMPARISON OF SITE CONCENTRATIONS AT THE BEARING SHOP TO RBCs
TABLE 3-15	COMPARISON OF SITE CONCENTRATIONS AT THE WHEEL SHOP TO RBCs
TABLE 3-16	COMPARISON OF SITE CONCENTRATIONS AT THE POWER HOUSE TO RBCs
TABLE 3-17	COMPARISON OF SITE CONCENTRATIONS AT THE OIL AND WASTE HOUSE TO RBCs
TABLE 3-18	COMPARISON OF SITE CONCENTRATIONS AT THE TEMPORARY HAZARDOUS WASTE STORAGE AREA TO RBCs
TABLE 3-19	COMPARISON OF SITE CONCENTRATIONS AT THE EAST CAR DISMANTLE AREA TO RBCs
TABLE 3-20	COMPARISON OF SITE CONCENTRATIONS AT THE WEST CAR DISMANTLE AREA TO RBCs
TABLE 3-21	COMPARISON OF SITE CONCENTRATIONS AT THE PAINT BARREL PITS TO RBCs
TABLE 3-22	COMPARISON OF SITE CONCENTRATIONS AT THE CAR SHOP TO RBCs
TABLE 3-23	COMPARISON OF SITE CONCENTRATIONS AT THE STEEL SHOP TO RBCs
TABLE 3-24	COMPARISON OF SITE CONCENTRATIONS AT THE CAR HOLDING AREA TO RBCs
TABLE 3-25	COMPARISON OF SITE CONCENTRATIONS AT THE CAR DEMOLISH AREA TO RBCs
TABLE 3-26	COMPARISON OF SITE CONCENTRATIONS AT THE SOUTH OPEN DRUM STORAGE AREA TO RBCs
TABLE 3-27	COMPARISON OF SITE CONCENTRATIONS AT THE NORTH OPEN DRUM STORAGE AREA TO RBCs

LIST OF TABLES

TABLE 3-28	COMPARISON OF SITE CONCENTRATIONS AT THE EIGHTH STREET YARD (CENTRAL) TO RBCs
TABLE 3-29	COMPARISON OF SITE CONCENTRATIONS AT THE EIGHTH STREET YARD (NORTH) TO RBCs
TABLE 3-30	COMPARISON OF SITE CONCENTRATIONS AT THE EIGHTH STREET YARD (SOUTH) TO RBCs
TABLE 3-31	COMPARISON OF SITE CONCENTRATIONS AT THE GRACE STREET YARD TO RBCs
TABLE 3-32	COMPARISON OF SITE CONCENTRATIONS AT THE GRACE STREET TANK TO RBCs
TABLE 3-33	COMPARISON OF SITE CONCENTRATIONS AT THE OIL PIPELINE TO RBCs
TABLE 3-34	COMPARISON OF SITE CONCENTRATIONS AT THE CONSTRUCTION AREA TO RBCs

LIST OF FIGURES

FIGURE 2-1	SITE LOCATION MAP
FIGURE 2-2	SITE PLAN

EXECUTIVE SUMMARY

The purpose of this screening-level risk assessment was to evaluate whether chemicals detected at the Union Pacific Railroad (UPRR) Omaha Shops and Maintenance Facility could potentially pose an unacceptable risk to human health. This property is currently the subject of various redevelopment proposals, including use as commercial and recreational property; therefore, evaluation of the potential for risks to human health from exposure to site-related chemicals is crucial in helping determine appropriate future uses for the property.

The screening-level risk evaluation was used to evaluate the potential for risks to human health for three hypothetical future exposure scenarios (occupational, construction, and recreational) for the site. The screening-level risk evaluation compared contaminant concentrations to risk-based concentrations (RBCs) for the specific exposure scenarios. RBCs are soil concentrations that, with the conservative exposure assumptions, would not be expected to result in unacceptable human health risks. Elements of this approach included:

- Developing exposure scenarios for future potential uses for the property
- Identifying chemicals of concern
- Calculating RBCs for the reasonable maximum exposure scenario (RME) for each of the future potential property uses
- Comparing concentrations of metals detected in environmental media (soil) to background levels
- Comparing concentrations of chemicals detected in environmental media (soil) at various sites on the property to the calculated RBCs

To evaluate potential health risks that may be posed by exposures to contaminants in soils at the UPRR Omaha Shops and Maintenance Facility, concentrations detected at 31 sites at the facility were compared to calculated RBCs. RBCs were derived for chemicals detected in soil at the 31 sites (field investigations for 30 of the sites were conducted by HDR Engineering, Inc. [HDR 1990] and for one site by Woodward-Clyde [W-C 1993]).

For this evaluation, RBCs were calculated for occupational workers, construction workers, and child recreational receptors based on very conservative assumptions of exposure and target risk levels. Actual exposures to contaminants at the sites are expected to be much lower. Metals which were determined to be above critical background values and any detected organic compounds were compared to the RBCs.

It is important to note that the RBCs are screening-level tools based on conservative, nonsite-specific exposure assumptions and should not be considered to represent comprehensive assessment of potential health risks at a site. The RBC method does not account for site-specific exposure factors or the potential cumulative effect of exposure to multiple chemicals. Also, the relationship between RBCs and exposure scenarios is complex. For instance, if the exposure time is doubled, the RBC may not be halved. In addition, for the majority of the sites investigated by HDR (28 of 30), data is from soil borings that were composited into a single sample. This method gives only one result per chemical per site and does not take into account the possible vertical and areal variation of chemical contamination within a site.

Fourteen of the Omaha Shops sites had chemical concentrations which exceeded one or more RBCs. Eleven of the fourteen sites had concentrations that exceeded RBCs by less than an order of magnitude for all scenarios. Therefore, significant human health risks from exposure to soil would not be expected at these sites, which included the following:

- Oil Storage Area
- Wastewater Treatment/Babbitt Shop Area
- Blue Building
- Acetylene Pit
- Power House
- Hazardous Waste Storage Area

- Paint Barrel Pits
- Steel Shop
- Car Demolish Area
- Traction Motor Shop
- Open Drum Storage Area (North)

Three of the sites had concentrations that exceeded one or more RBCs by more than a factor of ten. At the north area of the Eighth Street Yard, arsenic concentrations exceeded the recreational and occupational RBCs by factors of 12 and 19 times, respectively. At the south area of the Eighth Street Yard, arsenic concentrations exceeded the recreational and occupational RBCs by factors of 24 and 37 times, respectively. At the Construction Area, arsenic concentrations exceeded the RBC by a factor of about 25. However, the estimated lifetime excess cancer risk associated with these arsenic concentrations, based on comparison to RBCs, is within the EPA's target risk range of 1×10^{-6} to 1×10^{-4} (1 in 1,000,000 to 1 in 10,000) for exposures to chemicals released from hazardous waste sites (EPA 1991d). Therefore, considering that actual recreational or occupational exposures to contaminated soil would be much lower than those assumed for the RBCs, significant human health risks would not be expected at these sites.

At the Storage Tank Area near the Blue Building, PCE concentrations exceeded the occupational RBC by a factor of about 700. This concentration may be high enough to warrant further evaluation of the site; however, since earlier efforts to confirm the presence of PCE in the soil at this area failed to detect PCE, the high PCE concentration detected is highly suspect.

Since only three of the thirty-one sites had detected concentrations that exceeded RBCs by more than a factor of 10, it can be concluded that the vast majority of the Omaha Shops and Maintenance Facility area poses very little potential for human health risks. However, three of the areas have localized contamination at concentrations that may warrant further evaluation.

1.0
INTRODUCTION AND PURPOSE

The purpose of this screening-level risk assessment was to evaluate whether chemicals detected at the Union Pacific Railroad (UPRR) Omaha Shops and Maintenance Facility could potentially pose an unacceptable risk to human health. This property is currently the subject of various redevelopment proposals, including use as commercial and recreational property; therefore, evaluation of the potential for risks to human health from exposure to site-related chemicals is crucial in helping determine appropriate future uses for the property.

A screening-level risk evaluation was used to evaluate the potential for risks to human health for three hypothetical future exposure scenarios (occupational, construction, and recreational) for the site. The screening-level risk evaluation compares contaminant concentrations to risk-based concentrations (RBCs) for the specific exposure scenarios. RBCs are soil concentrations that, with the conservative exposure assumptions, would not be expected to result in unacceptable human health risks. Elements of this approach include:

- Developing exposure scenarios for future potential uses for the property
- Identifying chemicals of concern
- Calculating RBCs for the reasonable maximum exposure scenario (RME) for each of the future potential property uses
- Comparing concentrations of metals detected in environmental media (soil) to background levels
- Comparing concentrations of chemicals detected in environmental media (soil) at various sites on the property to the calculated RBCs

2.0
METHODOLOGY

To evaluate potential health risks that may be posed by exposures to contaminants in soils at the UPRR Omaha Shops and Maintenance Facility, concentrations detected at 31 sites at the facility were compared to calculated risk-based concentrations (RBCs). RBCs are conservative estimates of chemical concentrations in environmental media (e.g., soil) below which unacceptable risk of adverse health effects are not expected, given specific assumptions regarding exposure to the media. RBCs were derived for chemicals detected in soil at the 31 sites (field investigations for 30 of the sites were conducted by HDR Engineering, Inc. [HDR 1990] and for one site by Woodward-Clyde [W-C 1993]). Figure 2-1 shows the location of the Omaha Shops and Maintenance Facility in downtown Omaha. Figure 2-2 shows the individual sites at the facility.

Two levels of exposure can be used to develop RBCs: a reasonable maximum exposure (RME) which represents the highest plausible exposure, and an average exposure which represents more likely, yet conservative exposures. The RBCs for the UPRR Omaha Shops sites were developed using RME assumptions which represent the highest plausible exposures for three potential scenarios: recreational users, occupational workers, and construction workers. This is a very conservative approach; therefore, actual risks for the three potential future land uses are very likely to be significantly less.

2.1 COMPARISON TO RISK-BASED CONCENTRATIONS

RBCs were calculated for each detected chemical with EPA-established toxicity factors for the three exposure scenarios. The calculated RBCs were compared to the maximum detected site concentrations to estimate whether exposures could present unacceptable health risks. The comparison of maximum site concentrations to RBCs is summarized in Section 3.0. The following chemicals detected at the UPRR Omaha Shops and Maintenance Facility do not have EPA-established toxicity factors; therefore, RBCs could not be calculated:

- Acenaphthylene
- alpha-BHC (alpha-Benzenehexachloride or alpha-Lindane)

- Benzo(g,h,i)perylene
- delta-BHC
- Dibenzofuran
- Endosulfan sulfate
- Endosulfan II
- Endosulfan I
- Endrin aldehyde
- Lead
- 2-Methylnaphthalene
- Phenanthrene

Although lead does not have EPA-established toxicity factors, EPA guidance suggests that 1,000 mg/kg is an acceptable concentration for lead in residential soil (EPA 1989b). Therefore, 1,000 mg/kg is used as an RBC for this evaluation. This is a very conservative approach for nonresidential land uses.

It is important to note that the RBCs are screening-level tools based on conservative, nonsite-specific exposure assumptions and should not be considered to represent comprehensive assessment of potential health risks at a site. The RBC method does not account for site-specific exposure factors or the potential cumulative effect of exposure to multiple chemicals. Also, the relationship between RBCs and exposure scenarios is complex. For instance, if the exposure time is doubled, the RBC may not be halved. In addition, for the majority of the sites investigated by HDR (28 of 30), data is from soil borings that were composited into a single sample. This method gives only one result per chemical per site and does not take into account the possible vertical and areal variation of chemical contamination within a site.

2.2 DERIVATION OF RBCs

The calculation of an RBC for a chemical for a particular scenario takes into account type of receptor (e.g., occupational worker, construction worker, recreational user), exposure pathways and routes (e.g., inhalation, ingestion of, or dermal contact with soil), exposure parameters (e.g., exposure duration, exposure frequency, body weight), physical properties of the environmental medium, and toxicity of the chemical of concern. The following sections

detail the receptors that may be potentially exposed to site-related chemicals, the routes by which they may be exposed, the equations used to derive RBCs, and a description of the sources and assumptions behind each parameter in the equations.

2.2.1 Receptors and Exposure Pathways

For purposes of this evaluation, only exposure to chemicals detected in soil were evaluated. Assumed potential future receptors to site-related chemicals were recreational users, occupational workers, and construction workers. The routes by which they may be exposed and which were considered in the calculation of RBCs are:

- Ingestion of soil
- Inhalation of volatile chemicals and chemicals bound to airborne particulates emitted from soil
- Dermal contact with soil

2.2.2 Risk-Based Concentration Equations

The following equations were used for the calculation of RBCs from exposure to soil for recreational, occupational, and construction exposure scenarios. The equation for noncarcinogenic chemicals uses oral and inhalation reference doses (Rfd_o and Rfd_i) and a target hazard index (THI); whereas, the equation for carcinogenic chemicals uses oral and inhalation slope factors (SF_o and SF_i) and target risk (TR). These terms are described in the following sections. All other parameters are the same for the noncarcinogenic and carcinogenic equations. Table 2-1 lists the values and units of the constants used in the equations. Tables 2-2, 2-3, and 2-4 show the RBC calculations for each chemical for the construction worker, occupational worker, and recreational user scenarios, respectively.

Noncarcinogens

$$RBC = \frac{THI * BW * 365 d/y}{FC * EF * ED \left[\left(\frac{1}{RfD_o} * ME * IngR * 10^{-6}\right) + \left(\frac{1}{RfD_i} * CR\right) + \left(\frac{1}{RfD_i} * InhR \left(\frac{1}{VF} + \frac{1}{PEF}\right)\right)\right]}$$

Carcinogens

$$RBC = \frac{TR * BW * 365 d/y}{FC * EF * ED \left[\left(SF_o * ME * IngR * 10^{-6}\right) + \left(SF_0 * CR\right) + \left(SF_i * InhR \left(\frac{1}{VF} + \frac{1}{PEF}\right)\right)\right]}$$

where

THI	=	Target Hazard Index (unitless)
TR	=	Target Risk (unitless)
BW	=	Body Weight (kg)
EF	=	Exposure Frequency (d/y)
ED	=	Exposure Duration (y)
RfD_o and RfD_i	=	Reference Doses (oral and inhalation) (mg/kg-d)
SF_o and SF_i	=	Slope Factors (oral and inhalation) $(mg/k\text{-}d)^{-1}$
$IngR$	=	Ingestion Rate (mg/d)
CR	=	Contact Rate (dermal) (kg/d)
$InhR$	=	Inhalation Rate (m^3/d)
VF	=	Volatilization Factor (m^3/kg)
PEF	=	Particle Emission Factor (m^3/kg)
ME	=	Matrix Effect (unitless)
FC	=	Fraction from contaminated source (unitless)

Numerous chemicals (arsenic, beryllium, cadmium, chromium, tetrachloroethene, gasoline, chlordane, 4,4-DDT, heptachlor, heptachlor epoxide, dieldrin, and gamma-BHC) have suspected or known carcinogenic effects in addition to noncarcinogenic effects. Therefore, noncarcinogenic and carcinogenic RBCs were calculated for each chemical for each scenario. The lower (more conservative) RBC was used in the comparison to site concentrations.

2.2.3 Reference Doses and Slope Factors

RfDs and slope factors are chemical-specific EPA-recommended toxicity factors which were obtained from EPA's Integrated Risk Information System (IRIS) database (EPA 1993b), the Health Effects Assessment Summary Tables (HEAST) (EPA 1991a; 1992a; 1993a), or EPA technical memoranda (EPA 1992b). An RfD is the daily dose of a noncarcinogen that is unlikely to result in toxic effects to humans over a lifetime of exposure. Inhalation and oral reference doses (RfD_i and RfD_o) are used for evaluating potential noncarcinogenic effects in humans resulting from contaminant exposures (EPA 1991b). Inhalation and oral slope factors (SF_i and SF_o) are used to estimate an upper-bound probability of an individual's developing cancer as a result of a lifetime of exposure to particular levels of a potential carcinogen (EPA 1991b). Tables 2-5 and 2-6 summarize RfDs for noncarcinogenic chemicals of concern and slope factors for carcinogenic chemicals of concern, respectively.

2.2.4 Target Hazard Index for Noncarcinogens and Target Risk for Carcinogens

A hazard quotient (HQ) is the ratio of an exposure level (average daily exposure dose) of a single substance to the reference dose (RfD) for that substance. A hazard index (HI) is the sum of two or more hazard quotients. A target hazard index (THI) less than or equal to 1 indicates that no adverse noncarcinogenic health effects are expected to occur due to exposure to a chemical from all significant exposure pathways, even to sensitive individuals over a lifetime of exposure (EPA 1991c). A hazard index above 1 indicates a potential cause for concern for noncarcinogenic health effects and the need for further evaluation of assumptions about exposure and toxicity. For the purpose of this evaluation, the THI was assumed to be 1.00 for noncarcinogens.

Potential carcinogenic effects are characterized in terms of the excess probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen from all significant exposure pathways for a given medium. Excess probability means the increased probability over and above the normal probability of getting cancer, which in the United States is 1 in 3 (American Cancer Society 1990). For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper-bound lifetime cancer risk between 1×10^{-6} and 1×10^{-4} to an individual (EPA 1991c).

For the purposes of this evaluation, the most conservative value, 1×10^{-6}, was used as the target risk.

2.2.5 Exposure Parameters and Assumptions

The values of the exposure parameters used to calculate RBCs specifically for the UPRR Omaha Shops and Maintenance Area are detailed below.

- For occupational receptors, exposure frequency and duration was estimated to be 250 days/year for 25 years. Recreational receptors, in this case defined as children 0-7 years old, were estimated to have an exposure frequency of 32 days/year for 7 years (1 visit/week for 8 months/year). Construction receptors were assumed to have an exposure frequency of 40 days/year for 1 year (8 work weeks) (EPA 1991b).

- The parameter, averaging time (AT), is expressed in days to calculate average daily intake of a chemical. For noncarcinogenic chemicals, intakes are calculated by averaging over the exposure period to yield an average daily intake. For carcinogens, intakes are calculated by averaging the total cumulative dose over a 70-year lifetime, yielding "lifetime average daily intake". Different averaging times are used for carcinogens and noncarcinogens because it is thought that their effects occur by different mechanisms (EPA 1989). Averaging time for noncarcinogenic effects is equal to 25 years, 7 years, and 1 year for occupational, recreational, and construction receptors, respectively. For carcinogenic effects, the averaging time is 70 years for all three scenarios (EPA 1989).

- The average adult body weight is 70 kg (EPA 1989). This value was used for the occupational and construction worker scenarios. For recreational receptors, body weight (children from ages 0-7) was assumed to be 14.5 kg. This was calculated as the average of the body weights of children of 3, 4, 5, and 6 years of age (EPA 1989).

2.2.6 Air Inhalation Assumptions

- The inhalation rate for recreational receptors was estimated to be 16 m^3/day for an 8-hour day (EPA 1989). The inhalation rate for occupational workers and construction workers was estimated to be 20 m^3/day for an 8-hour day (EPA 1991b).

2.2.7 Soil Ingestion Assumptions

- The soil ingestion rates for recreational and occupational receptors were 200 and 50 mg/day, respectively (EPA 1991b). The soil ingestion rate for construction workers was estimated to be 100 mg/day (EPA 1989).

- It was assumed that the matrix effect of soil on bioavailability of ingested contaminants is 0.5 for all three exposure scenarios. The matrix effect describes the reduced availability due to absorption of chemicals to soil compared with the same chemical dose administered in solution in laboratory experiments. A matrix effect of 1.0 would indicate that all of the contaminants in a particular medium is bioavailable.

2.2.8 Soil Contact Rate

Uptake of chemicals via dermal contact depends on the body surface area, fraction absorbed, exposure duration and frequency, the adherence factor (amount of soil which adheres to skin), and the fraction of contacted soil that is contaminated. The soil contact rate was calculated by the following equation:

$$CR = SA * AdF * AbF * 10^{-6}\ kg/mg$$

where

CR = Contact Rate (kg/d)
SA = Surface Area of exposed body (cm^2/d)
AdF = Adherence Factor (mg/cm^2)
AbF = Absorbed Fraction

- A soil adherence factor of 0.2 mg/cm^2 (EPA 1992) was used for all exposure scenarios.

- The absorbed fraction of all noncarcinogenic and carcinogenic chemicals was assumed to be 0.01 (EPA 1989). This is a conservative value for most chemicals, but it may underestimate absorption for some chemicals.

- The exposed body surface area for recreational, occupational, and construction receptors was 3,320 cm^2, 2,000 cm^2, and 2,000 cm^2, respectively. For recreational receptors, exposed body surface area (children 0-7 years of age) is based on the average of head, arm, hand, leg, and foot surface area for ages 1-2, 2-3, 3-4, 4-5, 5-6, and 6-7 (EPA 1989). This value was then multiplied by the average body surface area (50th percentile) for females and males for the same age groups, to obtain the dermal contact rate. Adult surface areas are equivalent to hands and forearms (EPA 1989).

- Dermal contact could not be evaluated quantitatively for carcinogenic PAHs. EPA guidance (EPA 1989) states that it is inappropriate to use the oral slope factor to evaluate the risks associated with dermal exposure to carcinogens, such as benzo(a)pyrene, which cause skin cancer through a direct action at the point of application. Therefore, the contact rate for carcinogenic PAHs was set equal to 0 in the RBC equations.

- Fraction of contacted soil that is contaminated was assumed to be 0.5 for recreational and occupational receptors. For construction receptors, this value was assumed to be 1.0.

2.2.9 Air Emissions

2.2.9.1 Volatilization of VOCs from Soils

To estimate volatile emissions from soil, a volatilization factor (*VF*) is used to define the relationship between the concentration of contaminants in soil and the concentration of volatilized contaminants in air. The model assumes that the soil contaminant concentration

is at or below saturation. Above saturation, pure liquid-phase contaminant is present in the soil, and the model is not appropriate. The model further assumes that the soil is homogeneous from the soil surface to the depth of concern and that the contaminated material is not covered by contaminant-free soil material. For the purpose of calculating VF, depth of concern is defined as the depth at which a near impenetrable layer or the permanent groundwater level is reached. Volatilization is an important pathway only for chemicals with a molecular weight of less than 200 g/mole and a Henry's Law constant of 1×10^{-5} or greater (EPA 1991c). The *VF* is calculated using the following equation:

$$VF = \frac{LS * V * DH}{A} * \frac{\left(\pi * \frac{D_{ei} * E}{E + (\rho_s)(1-E)/K_{as}} * T\right)^{0.5}}{2 * D_{ei} * E * K_{as} * 10^{-3} kg/g}$$

where:

VF	= volatilization factor (m^3/kg)		
LS	= length of side of contaminated area (m)	=	45 m
V	= wind speed in mixing zone (m/s)	=	2.25 m/s
DH	= diffusion height (m)	=	2 m
A	= area of contamination (cm^2)	=	20,250,000 cm^2 (0.5 acre)
D_{ei}	= effective diffusivity (cm^2/s)	=	$D_i * E^{0.33}$
E	= true soil porosity (unitless)	=	0.35
K_{as}	= soil/air partition coefficient (g soil/cm^3 air)	=	$(H/K_d)*41$ (where 41 is a conversion factor)
p_s	= true soil density (g/cm^3)	=	2.65 g/cm^3
T	= exposure interval (s)	=	7.9×10^8 s (25 years)
D_i	= molecular diffusivity (cm^2/s)	=	chemical-specific
H	= Henry's Law constant (atm-m^3/mol)	=	chemical-specific
K_d	= soil-water partition coefficient (cm^3/g)	=	chemical-specific
K_{oc}	= organic carbon partition coefficient (cm^3/g) (used to estimate K_d)	=	chemical-specific
OC	= organic carbon content of soil (fraction) (used to estimate K_d)	=	0.02

The default values listed above assume a residential lot of one-half acre, reasonable estimates of annual average wind speed and soil characteristics, and a mixing height of 2 m (6 feet). The volatile organic emissions from soil are assumed to disperse in a volume determined by the surface area (2,025 m^2) times the mixing height (2 m). Air concentrations of airborne volatile compounds are calculated by multiplying the *VF* by the soil concentration of each chemical of concern. Air concentrations of VOCs are probably overpredicted by this approach because it is assumed that VOCs are in the surface soil layer, that the entire area is contaminated by RME concentrations of VOCs, and that concentrations of VOCs remain constant in soils indefinitely.

For the calculation of RBCs, volatilization factors were calculated for all detected VOCs. The volatilization factors for these VOCs are:

Analyte	Volatilization Factor (m^3/kg)
Acetone	8.82E+03
2-Butanone	1.09E+04
Benzene	2.11E+04
Ethylbenzene	1.39E+04
Methylene Chloride	4.25E+02
Tetrachloroethene	3.73E+03
Trichloroethene	3.53E+-3
Toluene	6.71E+03
Xylene	4.03E+03

2.2.9.2 Particulate Emissions from Soils

Exposures to semivolatile chemicals and metals of concern may occur through inhalation of windborne particulate emissions of respirable size (PM_{10}) to which the chemicals may adhere. The equation used to estimate long-term (annual) average particulate emissions from wind erosion is from Cowherd (1985) as cited in EPA (1991c). The equation, which calculates a particle emission factor (*PEF*), is expressed as:

$$PEF\ (m^3/kg) = \frac{LS\,x\,V\,x\,DH\,x\,3{,}600\,s/hr}{A}\ x\ \frac{1{,}000\,g/kg}{0.036\,x\,(1-G)\,x\left(\frac{U_m}{U_i}\right)^3\,x\,F(x)}$$

where:

PEF	=	particulate emission factor (m^3/kg)	4.63 x 10^9 m^3/kg
LS	=	width of contaminated area (m)	45 m
V	=	wind speed in mixing zone (m/s)	2.25 m/s
DH	=	diffusion height (m)	2 m
A	=	area of contamination (cm^2)	20,250,000 cm^2 (0.5 acre)
0.036	=	respirable fraction (g/m^2-hr)	0.036 g/m^2-h
G	=	fraction of vegetative cover	0
U_m	=	mean annual wind speed	4.5 m/sec
U_i	=	equivalent threshold value of wind speed at 10 m	12.8 m/sec
F(x)	=	function dependent on $\frac{U_m}{U_i}$ (0.0497 determined using Cowherd 1985)	

The particulate emission factor (*PEF*) described in the equation relates the contaminant concentration in soil with the concentration of respirable particles (PM_{10}) in the air due to fugitive dust emissions from surface contamination sites. This relationship is derived by Cowherd (1985) for a rapid assessment procedure applicable to a typical hazardous waste site where the surface contamination provides a relatively continuous and constant potential for emission over an extended period of time (e.g., years). The particulate emissions from contaminated sites are due to wind erosion and, therefore, depend on the erodibility of the surface material. The equation presented above is representative of a surface with "unlimited erosion potential," which is characterized by bare surfaces of finely divided material such as sandy agricultural soil with a large number ("unlimited reservoir") of erodible particles. Such surfaces erode at low wind speeds. This model was selected by EPA because it represents a conservative estimate for intake of particulates.

Air concentrations of particulate-bound semivolatiles and metals are calculated by multiplying the *PEF* by the soil concentration of each chemical of concern. The air concentrations calculated using this equation probably overpredict actual air concentrations at the site,

because the equation assumes that there is no vegetative cover or pavement, that contaminants are in the surface soil layer, and that contaminant concentrations are constant for the exposure duration.

2.3 COMPARISON OF SITE METALS CONCENTRATIONS WITH BACKGROUND

Metals are natural constituents of soils and groundwater. Therefore, a comparison of site sample concentrations to background concentrations was used to assess whether metals in environmental samples may be naturally occurring or may be site-related (i.e., related to waste disposal practices at the site). Metals that are not characteristic of materials potentially placed at the site or that occur in concentrations within background levels are not considered site-related chemicals of concern and are not evaluated further in the RBC screening.

Two background samples were collected by HDR north of Grace Street from depth intervals of 0 to 1 foot and 3.5 to 5 feet and analyzed for metals. A critical background concentration for metals detected in the HDR background samples was defined as the highest concentration of the two background samples if the two concentrations did not vary by more than a factor of 2, or the average of the two concentrations if the two measured concentrations varied by more than a factor of 2. The critical background concentrations for copper, mercury, nickel, selenium, silver, and zinc were determined by averaging the measured concentrations. For metals that were analyzed for, but not detected in either HDR background sample (antimony, cadmium, and thallium), there was no critical background concentration. Therefore, any concentration detected at any site was considered to be above background. Omaha area elemental concentrations (USGS 1984) were used as critical background concentrations for metals that were not analyzed for in the HDR background samples (barium, manganese, and vanadium). In cases where the USGS data provided a range of concentrations, the upper value of the range was used as the critical background concentration. The background concentration range for lead in the downtown Omaha area was obtained from soil sample monitoring by the Douglas County Health Department in Heartland Park (Baker 1993). The Douglas County Health Department reported a background lead concentration of 300 to 400 mg/kg. The lower value of the range for lead concentration was used as the critical background concentration. Table 2-7 summarizes the background concentrations for the UPRR Omaha Shops and lists background concentrations for the Omaha Area (USGS 1984).

Table 2-8 compares metal concentrations detected at the sites with the critical background concentrations.

2.4 SAMPLING AND ANALYSIS

HDR investigated 30 sites at the UPRR Omaha Shops in 1990, and W-C investigated an area designated as the "Construction Area" in 1992. The Construction Area overlapped a few of the sites investigated by HDR. At 28 of the 30 sites investigated by HDR, one composite sample per site was collected from the borings on the sites. At the Wastewater Treatment Area/Babbitt Shop, discrete samples were analyzed for TPH, composite samples were analyzed for metals, and a composite sample at the Babbitt Shop was analyzed for VOCs. At the Oil Pipeline Area, nine discrete samples were analyzed for TPH. The analyses performed at the other sites are given in Section 3.0.

At 13 sites, several pesticides were co-eluted (beta-BHC, delta-BHC, gamma-BHC, heptachlor, heptachlor epoxide, and aldrin). Co-elution occurs when analytes have similar retention times, making it impossible to distinguish the individual peaks of the compounds. Co-elution was reported for beta-BHC and heptachlor, beta-BHC and heptachlor epoxide, aldrin and gamma-BHC, and aldrin and delta-BHC. For analytes which co-eluted, the total concentration of both of the analytes (if both are present) was reported. If both compounds are present, the percentages of each are unknown. Reporting the co-eluted total peak concentration for a compound may overestimate the actual concentration, resulting in a more conservative estimate of the potential risk (if any) present.

The Fuel Storage Area, New Transformer Storage Area, Old Transformer Storage Area, and the Old Traction Motor Shop were not evaluated in this report for the following reasons. At the Fuel Storage Area, no soil samples were collected; therefore, this area was not assessed in this report. At the New Transformer Storage Area and the Old Transformer Storage Area, three and four borings, respectively, were drilled. A composite sample was collected from each site and analyzed for PCBs. All PCBs were reported as nondetected for both sites; therefore, these areas were not evaluated in this report. Three borings were drilled at the Old Traction Motor Shops, and a composite sample was collected and analyzed for VOCs. All VOCs were reported as nondetect at the site; therefore, this site was not evaluated in this report.

TABLE 2-1

CONSTANTS FOR RBC CALCULATIONS

	Recreational	Occupational	Construction
Target Hazard Index (Noncarcinogenic)	1.00	1.00	1.00
Target Risk (Carcinogenic)	1.00E-06	1.00E-06	1.00E-06
Body Weight (kg)	14.5(1)	70(2)	70(2)
Averaging Time (y) (Noncarcinogenic)	7(1)	25(2)	1(3)
Averaging Time (y) (Carcinogenic)	70(1)	70(2)	70(3)
Exposure Frequency (d/y)	32(3)	250(2)	40(3)
Exposure Duration (y)	7(3)	25(2)	1(3)
Ingestion Rate (Soil) (mg/d)(8)	200(2)	50(2)	100(1)
Inhalation Rate (Air) (m^3/d)(8)	16(1)	20(2)	20(2)
Contact Rate (kg/d)(5)(7)	6.64E-06	4.00E-06	4.00E-06
Surface Area (cm^2/d)	3320(1)	2000(1)	2000(3)
Adherence Factor (mg/cm^2)	0.2(4)	0.2(4)	0.2(4)
Absorbed fraction	0.01(1)	0.01(1)	0.01(1)
Fraction from contaminated source	0.5(3)	0.5(3)	1(3)
Matrix Effect	0.5(3)	0.5(3)	0.5(3)
Particle Emission Factor (m^3/kg)(6)	4.63E+09	4.63E+09	4.63E+09

(1) Exposure Factors Handbook, EPA 1989.

(2) Standard Default Exposure Factors, EPA 1991.

(3) Assumed value.

(4) Dermal Exposure Assessment: Principles and Applications (EPA 1992) .

(5) Soil Contact Rate=RME dermal contact rate based on exposed surface area*adherence factor*absorbed fraction.

(6) Particle Emission Factor=EPA standard default value; measure of dust production from wind erosion (EPA 1991) .

(7) The Soil Contact Rate for carcinogenic PAHs was set equal to zero because dermal exposure to carcinogenic PAHs cannont be quantitatively assessed.

(8) Ingestion rate and inhalation rate are for an 8-hour day.

TABLE 2-2a

RBC CALCULATIONS FOR THE CONSTRUCTION WORKER SCENARIO

CARCINOGENIC

	Target Risk	Inhalation Slope Factor 1/(mg/kg-d)	Oral Slope Factor 1/(mg/kg-d)	Body Wght (kg)	Ave. Time (y)	Exposure Frequency (d/y)	Exposure Duration (y)	Vol. Factor (m^3/kg)	Particle Emission Factor (m^3/kg)	Ingestion Rate (Soil) (mg/d)	Inhalation Rate (Air) (m^3/d)	Contact Rate (kg/d)	Matrix Effect	Fraction Contacted	RBC (mg/kg)
METAL															
Arsenic	1.00E-06	1.50E+01	1.75E+00	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	4.73E+02
Berylllium	1.00E-06	8.40E+00	4.30E+00	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	1.93E+02
Cadmium	1.00E-06	6.10E+00	ND	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	6.79E+07
Lead (1)	1.00E-06	ND	ND	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	
Chromium VI	1.00E-06	4.10E+01	0.00E+00 ?	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	2.52E+05
VOLATILE															
Benzene	1.00E-06	2.90E-02	2.90E-02	70	70	40	1	2.11E+04	4.63E+09	100	20	4.00E-06	0.50	1.00	1.54E+03
Methylene chloride	1.00E-06	1.60E-03	7.50E-03	70	70	40	1	4.25E+02	4.63E+09	100	20	4.00E-06	0.50	1.00	5.91E+02
Tetrchloroethene	1.00E-06	1.80E-03	5.00E-03	70	70	40	1	3.73E+03	4.63E+09	100	20	4.00E-06	0.50	1.00	4.51E+03
Trichloroethene	1.00E-06	6.00E-03	1.10E-02	70	70	40	1	3.53E+03	4.63E+09	100	20	4.00E-06	0.50	1.00	1.29E+03
SEMIVOLATILE		5.7 E-02 →													
Benzo(a)anthracene	1.00E-06	8.80E-01	1.06E+00 ?	70	70	40	1	0	4.63E+09	100	20	0.00E+00	0.50	1.00	8.44E+02
Benzo(a)pyrene	1.00E-06	6.10E+00	7.30E+00 (1.7+1)	70	70	40	1	0	4.63E+09	100	20	0.00E+00	0.50	1.00	1.22E+02
Benzo(b)fluoranthene	1.00E-06	8.50E-01	1.02E+00	70	70	40	1	0	4.63E+09	100	20	0.00E+00	0.50	1.00	8.77E+02
Benzo(k)fluoranthene	1.00E-06	4.80E-01	4.00E-01	70	70	40	1	0	4.63E+09	100	20	0.00E+00	0.50	1.00	2.24E+03
Bis(2-ethylhexyl)phthalate	1.00E-06	ND	1.40E-02	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	5.91E+04
Indeno(1,2,3-cd)pyrene	1.00E-06	1.42E+00	1.69E+00	70	70	40	1	0	4.63E+09	100	20	0.00E+00	0.50	1.00	5.29E+02
N-Nitrosodiphenylamine	1.00E-06	ND	4.90E-03	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	1.69E+05
Chrysene	1.00E-06	2.70E-02	3.20E-02	70	70	40	1	0	4.63E+09	100	20	0.00E+00	0.50	1.00	2.79E+04
Dibenzo(a,h)anthracene	1.00E-06	6.77E+00	8.10E+00	70	70	40	1	0	4.63E+09	100	20	0.00E+00	0.50	1.00	1.10E+02
N-nitrosodi-n-propylamine	1.00E-06	ND	7.00E+00	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	1.18E+02
PESTICIDE/PCB															
Chlorodane	1.00E-06	1.30E+00	1.30E+00	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	6.37E+02
Aroclors (PCBs) (2)	1.00E-06	ND	7.70E+00	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	1.08E+02
4,4'DDT	1.00E-06	3.40E-01	3.40E-01	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	2.44E+03
4,4'DDE	1.00E-06	ND	3.40E-01	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	2.44E+03
4,4'DDD	1.00E-06	ND	2.40E-01	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	3.45E+03
Heptachlor	1.00E-06	4.50E+00	4.50E+00	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	1.84E+02
Heptachlor epoxide	1.00E-06	9.10E+00	9.10E+00	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	9.10E+01
Dieldrin Alpha BHC	1.00E-06	1.60E+01	1.60E+01	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	5.17E+01
gamma BHC	1.00E-06	ND	1.30E+00	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	6.37E+02
beta BHC Delta BHC	1.00E-06	1.80E+00	1.80E+00	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	4.60E+02
Aldrin	1.00E-06	ND (1.7+1)	1.70E+01	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	4.87E+01
Gasoline	1.00E-06	ND	1.70E-03	70	70	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	9.74E+05

TABLE 2-2a

RBC CALCULATIONS FOR THE CONSTRUCTION WORKER SCENARIO

Notes:
Target HI = Target Hazard Index; Hazard Index <1.00 for noncarcinogens indicates no expected adverse health effects; target risk is 1 x 10^-6
Inhalation and oral RfDs: EPA provisional values from EPA's IRIS database and HEAST (EPA 1992, 1993)
Body weight and averaging time = standard EPA values (EPA 1989)
Exposure frequency and duration = assumed values
Fraction contacted and matrix effect = assumed values
Soil Ingestion Rate = standard intake of 100 mg/d for an 8-hour day
Air Inhalation Rate = standard intake rate of 20 m^3/d for an 8-hour day
Soil Contact Rate = RME dermal contact rate based on exposed surface area (3,000 cm^2)*adherence factor (0.5 mg/cm^2)*absorbed fraction (0.01).
Volatilization Factor = Chemical-specific measure of the quantity of a chemical that will volatilize from soil (EPA 1991).
Particle Emission Factor = EPA standard default value; measure of dust production from wind erosion (EPA 1991).
ND = no data
(1) These chemicals do not have inhalation or oral RfD values; therefore, RBCs could not be calculated.
(2) Aroclors = Aroclor 1016, 1221, 1232, 1242, 1248, and 1254.

RBC = (THI*BW*AT*365d/y)/{FC*EF*ED((1/RfDo*ME*IngR*10^-6)+(1/RfDo*CR)+(1/RfDi*InhR(1/VF+1/PEF)))} (Noncarcinogenic chemicals)
RBC=(TR*BW*AT*365d/y)/{FC*EF*ED((SFo*ME*IngR*10^-6)+(SFo*CR)+(SFi*InhR(1/VF+1/PEF)))} (Carcinogenic chemicals)

TABLE 2-2b

RBC CALCULATIONS FOR THE CONSTRUCTION WORKER SCENARIO

NONCARCINOGENIC

	Target HI	Inhalation RfD (mg/kg-d)	Oral RfD (mg/kg-d)	Body Weight (kg)	Ave. Time (y)	Exp. Freq. (d/y)	Exp. Dur. (y)	Vol. Factor (m^3/kg)	Particle Emission Factor (m^3/kg)	Ingestion Rate (Soil) (mg/d)	Inhalation Rate (Air) (m^3/d)	Contact Rate (kg/d)	Matrix Effect	Fraction Contacted	RBC (mg/kg)
METAL**															
Antimony	1.00	ND	4.00E-04	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	4731
Arsenic	1.00	ND	3.00E-04	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	3549
Barium	1.00	1.40E-04	7.00E-02	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	796165
Beryllium	1.00	ND	5.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	59144
Cadmium (food)	1.00	ND	1.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	11829
Chromium III	1.00	ND	1.00E+00	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	11828704
Chromium (VI)	1.00	ND	5.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	59144
Copper	1.00	ND	3.70E-02	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	437662
Lead (1)		ND	ND												
Manganese	1.00	1.14E-04	5.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	58937
Mercury	1.00	3.00E-04	3.00E-04	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	3548
Nickel	1.00	ND	2.00E-02	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	236574
Silver	1.00	ND	5.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	59144
Selenium	1.00	ND	5.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	59144
Thallium (as thallic oxide)	1.00	ND	7.00E-05	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	828
Vanadium	1.00	ND	7.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	82801
Zinc	1.00	ND	3.00E-01	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	3548611
VOLATILE															
Methylene chloride	1.00	8.60E-01	6.00E-02	70	1	40	1	4.25E+02	4.63E+09	100	20	4.00E-06	0.50	1.00	11484
Acetone	1.00	ND	1.00E-01	70	1	40	1	8.82E+03	4.63E+09	100	20	4.00E-06	0.50	1.00	1182870
2-Butanone	1.00	2.86E-01	5.00E-02	70	1	40	1	1.09E+04	4.63E+09	100	20	4.00E-06	0.50	1.00	85144
Ethylbenzene	1.00	2.90E-01	1.00E-01	70	1	40	1	1.39E+04	4.63E+09	100	20	4.00E-06	0.50	1.00	116104
Toluene	1.00	1.10E-01	2.00E-01	70	1	40	1	6.71E+03	4.63E+09	100	20	4.00E-06	0.50	1.00	23340
Xylene (total)	1.00	ND	2.00E+00	70	1	40	1	4.03E+03	4.63E+09	100	20	4.00E-06	0.50	1.00	23657218
Tetrachloroethene	1.00	ND	1.00E-02	70	1	40	1	3.73E+03	4.63E+09	100	20	4.00E-06	0.50	1.00	118287
PESTICIDE/PCB															
alpha-BHC (1)		ND	ND												
delta-BHC (1)		ND	ND												
gamma-BHC (Lindane)	1.00	ND	3.00E-04	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	3549

TABLE 2-2b

RBC CALCULATIONS FOR THE CONSTRUCTION WORKER SCENARIO

NONCARCINOGENIC

	Target HI	Inhalation RfD (mg/kg-d)	Oral RfD (mg/kg-d)	Body Weight (kg)	Ave. Time (y)	Exp. Freq. (d/y)	Exp. Dur. (y)	Vol. Factor (m^3/kg)	Particle Emission Factor (m^3/kg)	Ingestion Rate (Soil) (mg/d)	Inhalation Rate (Air) (m^3/d)	Contact Rate (kg/d)	Matrix Effect	Fraction Contacted	RBC (mg/kg)
Heptachlor	1.00	ND	5.00E-04	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	5914
Aldrin	1.00	ND	3.00E-04	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	3549
Dieldrin	1.00	ND	5.00E-05	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	591
Heptaclor epoxide	1.00	ND	1.35E-05	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	160
4,4'DDT	1.00	ND	5.00E-04	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	5914
Endosulfan I (1)		ND	ND												
Endrin	1.00	ND	3.00E-04	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	3549
Endosulfan II (1)		ND	ND												
Endosulfan sulfate (1)		ND	ND												
Chlordane	1.00	ND	6.00E-05	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	710
Methoxychlor	1.00	ND	5.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	59144
Endrin aldehyde (1)		ND	ND												
SEMIVOLATILE															
Phenol	1.00	ND	6.00E-01	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	7097222
2-Methylphenol	1.00	ND	5.00E-02	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	591435
4-Methylphenol	1.00	ND	5.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	59144
2,4-Dimethylphenol	1.00	ND	2.00E-02	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	236574
2,4-Dichlorophenol	1.00	ND	3.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	35486
Anthracene	1.00	ND	3.00E-01	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	3548611
Pyrene	1.00	ND	3.00E-02	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	354861
Naphthalene	1.00	ND	4.00E-02	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	473148
Acenaphthylene (1)		ND	ND												
Acenaphthhene	1.00	ND	6.00E-02	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	709722
Diethylphthalate	1.00	ND	8.00E-01	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	9462963
Fluorene	1.00	ND	4.00E-02	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	473148
Fluoranthene	1.00	ND	4.00E-02	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	473148
Benzo(g,h,i)perylene (1)		ND	ND												
Bis(2-ethylhexyl)phthalate	1.00	ND	2.00E-02	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	236574
Di-n-butylphthalate	1.00	ND	1.00E-01	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	1182870
Di-n-octylphthalate	1.00	ND	2.00E-02	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	236574

TABLE 2-2b

RBC CALCULATIONS FOR THE CONSTRUCTION WORKER SCENARIO

NONCARCINOGENIC

	Target HI	Inhalation RfD (mg/kg-d)	Oral RfD (mg/kg-d)	Body Weight (kg)	Ave. Time (y)	Exp. Freq. (d/y)	Exp. Dur. (y)	Vol. Factor (m^3/kg)	Particle Emission Factor (m^3/kg)	Ingestion Rate (Soil) (mg/d)	Inhalation Rate (Air) (m^3/d)	Contact Rate (kg/d)	Matrix Effect	Fraction Contacted	RBC (mg/kg)
2-Methylnaphthalene(1)		ND	ND												
Dibenzofuran (1)		ND	ND												
Phenanthrene (1)		ND	ND												
PETROLEUM HYDROCARBON															
as #2 Diesel	1.00	ND	8.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	94630
as Gasoline--Regular	1.00	ND	2.00E-01	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	2365741
as Various Petroleums	1.00	ND	8.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	94630
as Fluids (2)	1.00	ND	8.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	94630
as #2 Fuel Oil	1.00	ND	8.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	94630
as #1 Fuel Oil	1.00	ND	8.00E-03	70	1	40	1	0	4.63E+09	100	20	4.00E-06	0.50	1.00	94630

**Al, Ca, Mg, K, Fe, Na usually not considered chemicals of concern

Notes:
Target HI = Target Hazard Index; Hazard Index <1.00 for noncarcinogens indicates no expected adverse health effects; target risk is 1 x 10^-6
Inhalation and oral RfDs: EPA provisional values from EPA's IRIS database and HEAST (EPA 1992, 1993)
Body weight and averaging time = standard EPA values (EPA 1989)
Exposure frequency and duration = assumed values
Fraction contacted and matrix effect = assumed values
Soil Ingestion Rate = standard intake of 100 mg/d for an 8-hour day
Air Inhalation Rate = standard intake rate of 20 m^3/d for an 8-hour day
Soil Contact Rate = RME dermal contact rate based on exposed surface area (3,000 cm^2)*adherence factor (0.5 mg/cm^2)*absorbed fraction (0.01).
Volatilization Factor = Chemical-specific measure of the quantity of a chemical that will volatilize from soil (EPA 1991).
Particle Emission Factor = EPA standard default value; measure of dust production from wind erosion (EPA 1991).
ND = no data
(1) These chemicals do not have inhalation or oral RfD values; therefore, RBCs could not be calculated.
(2) Fluids - brake, hydraulic, and transmission fluid.

RBC = (THI*BW*AT*365d/y)/{FC*EF*ED((1/RfDo*ME*IngR*10^-6)+(1/RfDo*CR)+(1/RfDi*InhR(1/VF+1/PEF)))} (Noncarcinogenic chemicals)
RBC=(TR*BW*AT*365d/y)/{FC*EF*ED((SFo*ME*IngR*10^-6)+(SFo*CR)+(SFi*InhR(1/VF+1/PEF)))} (Carcinogenic chemicals)

TABLE 2-3a

RBC CALCULATIONS FOR THE OCCUPATIONAL WORKER SCENARIO

CARCINOGENIC

	Target HI	Inhalation Slope Factor 1/(mg/kg-d)	Oral Slope Factor 1/(mg/kg-d)	Body Weight (kg)	Averagin Time (y)	Exposure Frequenc (d/y)	Exposure Duration (y)	Vol. Factor (m^3/kg)	Particle Emission Factor (m^3/kg)	Ingestion Rate (Soil) (mg/d)	Inhalation Rate (Air) (m^3/d)	Contact Rate (kg/d)	Matrix Effect	Fraction Contacted	RBC (mg/kg)
METAL															
Arsenic	1.00E-06	1.50E+01	1.75E+00	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	1.13E+01
Beryllium	1.00E-06	8.40E+00	4.30E+00	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	4.59E+00
Lead (1)		ND	ND												
Chromium VI	1.00E-06	4.10E+01	0.00E+00	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	3.23E+03
Cadmium	1.00E-06	6.10E+00	ND	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	2.17E+04
VOLATILE															
Benzene	1.00E-06	2.90E-02	2.90E-02	70	70	250	25	2.11E+04	4.63E+09	50	20	4.00E-06	0.50	0.50	6.80E+02
Methylene chloride	1.00E-06	1.60E-03	7.50E-03	70	70	250	25	4.25E+02	4.63E+09	50	20	4.00E-06	0.50	0.50	2.63E+03
Tetrchloroethene	1.00E-06	1.80E-03	5.00E-03	70	70	250	25	3.73E+03	4.63E+09	50	20	4.00E-06	0.50	0.50	3.95E+03
Trichloroethene	1.00E-06	6.00E-03	1.10E-02	70	70	250	25	3.53E+03	4.63E+09	50	20	4.00E-06	0.50	0.50	1.79E+03
SEMIVOLATILE															
Benzo(a)anthracene	1.00E-06	8.80E-01	1.06E+00	70	70	250	25	0	4.63E+09	50	20	0.00E+00	0.50	0.50	2.16E+01
Benzo(a)pyrene	1.00E-06	6.10E+00	7.30E+00	70	70	250	25	0	4.63E+09	50	20	0.00E+00	0.50	0.50	3.14E+00
Benzo(b)fluoranthene	1.00E-06	8.50E-01	1.02E+00	70	70	250	25	0	4.63E+09	50	20	0.00E+00	0.50	0.50	2.24E+01
Benzo(k)fluoranthene	1.00E-06	4.80E-01	4.00E-01	70	70	250	25	0	4.63E+09	50	20	0.00E+00	0.50	0.50	5.72E+01
Bis(2-ethylhexyl)phthalate	1.00E-06	ND	1.40E-02	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	1.41E+03
Indeno(1,2,3-cd)pyrene	1.00E-06	1.42E+00	1.69E+00	70	70	250	25	0	4.63E+09	50	20	0.00E+00	0.50	0.50	1.35E+01
N-Nitrosodiphenylamine	1.00E-06	ND	4.90E-03	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	4.03E+03
Chrysene	1.00E-06	2.70E-02	3.20E-02	70	70	250	25	0	4.63E+09	50	20	0.00E+00	0.50	0.50	7.15E+02
Dibenzo(a,h)anthracene	1.00E-06	6.77E+00	8.10E+00	70	70	250	25	0	4.63E+09	50	20	0.00E+00	0.50	0.50	2.83E+00
N-nitrosodi-n-propylamine	1.00E-06	ND	7.00E+00	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	2.82E+00
PESTICIDE/PCB															
Chlorodane	1.00E-06	1.30E+00	1.30E+00	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	1.52E+01
Aroclors (PCBs) (2)	1.00E-06	ND	7.70E+00	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	2.56E+00
4,4'DDT	1.00E-06	3.40E-01	3.40E-01	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	5.80E+01
4,4'DDE	1.00E-06	ND	3.40E-01	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	5.80E+01
4,4'DDD	1.00E-06	ND	2.40E-01	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	8.22E+01
Heptachlor	1.00E-06	4.50E+00	4.50E+00	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	4.38E+00
Heptachlor epoxide	1.00E-06	9.10E+00	9.10E+00	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	2.17E+00
Dieldrin	1.00E-06	1.60E+01	1.60E+01	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	1.23E+00
gamma BHC	1.00E-06	ND	1.30E+00	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	1.52E+01
beta BHC	1.00E-06	1.80E+00	1.80E+00	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	1.10E+01
Aldrin	1.00E-06	ND	1.70E+01	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	1.16E+00
Gasoline	1.00E-06	ND	1.70E-03	70	70	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	1.16E+04

TABLE 2-3a

RBC CALCULATIONS FOR THE OCCUPATIONAL WORKER SCENARIO

Notes:
Target HI = Target Hazard Index; Hazard Index <1.00 for noncarcinogens indicates no expected adverse health effects; target risk is 1 x 10^-6
Inhalation and oral RfDs: EPA provisional values from EPA's IRIS database and HEAST (EPA 1992, 1993)
Body weight and averaging time = standard EPA values (EPA 1989)
Exposure frequency and duration = assumed values
Fraction contacted and matrix effect = assumed values
Soil Ingestion Rate = standard intake of 50 mg/d for an 8-hour day
Air Inhalation Rate = standard intake rate of 20 m^3/d for an 8-hour day
Soil Contact Rate = RME dermal contact rate based on exposed surface area (2,000 cm^2)*adherence factor (0.5 mg/cm^2)*absorbed fraction (0.01).
Volatilization Factor = Chemical-specific measure of the quantity of a chemical that will volatilize from soil (EPA 1991).
Particle Emission Factor = EPA standard default value; measure of dust production from wind erosion (EPA 1991).
NA = not applicable
ND = no data
(1) These chemicals do not have inhalation or oral RfD values; therefore, RBCs could not be calculated.
(2) Aroclors = Aroclor 1016, 1221, 1232, 1242, 1248, and 1254.

RBC = (THI*BW*AT*365d/y)/{FC*EF*ED((1/RfDo*ME*IngR*10^-6)+(1/RfDo*CR)+(1/RfDi*InhR(1/VF+1/PEF)))} (Noncarcinogenic chemicals)
RBC=(TR*BW*AT*365d/y)/{FC*EF*ED((SFo*ME*IngR*10^-6)+(SFo*CR)+(SFi*InhR(1/VF+1/PEF)))} (Carcinogenic chemicals)

TABLE 2-3b

RBC CALCULATIONS FOR THE OCCUPATIONAL WORKER SCENARIO

Region II Industrial

NONCARCINOGENIC

	Target HI	Inhalation RfD (mg/kg-d)	Oral RfD (mg/kg-d)	Body Weight (kg)	Avg. Time (y)	Exp. Freq. (d/y)	Exp. Dur. (y)	Vol. Factor (m^3/kg)	Particle Emission Factor (m^3/kg)	Ingestion Rate (Soil) (mg/d)	Inhalation Rate (Air) (m^3/d)	Contact Rate (kg/d)	Matrix Effect	Fraction Contacted	RBC (mg/kg)	
METAL**																
Antimony	1.00	ND	4.00E-04	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	2819	680
Arsenic	1.00	ND	3.00E-04	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	2114	610
Barium	1.00	1.40E-04	7.00E-02	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	493379	3.0 C
Beryllium	1.00	ND	5.00E-03	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	35241	1.1 C
Cadmium (food)	1.00	ND	1.00E-03	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	7048	85 O
Chromium III	1.00	ND	1.00E+00	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	7048276	1600
Chromium (VI)	1.00	ND	5.00E-03	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	35241	
Copper	1.00	ND	3.70E-02	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	260786	63,000
Lead (1)		ND	ND													2000
Manganese	1.00	1.14E-04	5.00E-03	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	35241	
Mercury	1.00	3.00E-04	3.00E-04	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	2114	510
Nickel	1.00	ND	2.00E-02	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	140966	34000
Silver	1.00	ND	5.00E-03	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	35241	
Selenium	1.00	ND	5.00E-03	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	35241	
Thallium (as thallic oxide)	1.00	ND	7.00E-05	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	493	
Vanadium	1.00	ND	7.00E-03	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	49338	12000
Zinc	1.00	ND	3.00E-01	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	2114483	
VOLATILE																
Methylene chloride	1.00	8.60E-01	6.00E-02	70	25	250	25	4.25E+02	4.63E+09	50	20	4.00E-06	0.50	0.50	422897	
Acetone	1.00	ND	1.00E-01	70	25	250	25	8.82E+03	4.63E+09	50	20	4.00E-06	0.50	0.50	704828	
2-Butanone	1.00	2.86E-01	5.00E-02	70	25	250	25	1.09E+04	4.63E+09	50	20	4.00E-06	0.50	0.50	352414	
Ethylbenzene	1.00	2.90E-01	1.00E-01	70	25	250	25	1.39E+04	4.63E+09	50	20	4.00E-06	0.50	0.50	704828	
Toluene	1.00	1.10E-01	2.00E-01	70	25	250	25	6.71E+03	4.63E+09	50	20	4.00E-06	0.50	0.50	1409655	
Xylene (total)	1.00	ND	2.00E+00	70	25	250	25	4.03E+03	4.63E+09	50	20	4.00E-06	0.50	0.50	14096552	
Tetrachloroethene	1.00	ND	1.00E-02	70	25	250	25	3.73E+03	4.63E+09	50	20	4.00E-06	0.50	0.50	70483	
PESTICIDE/PCB																
alpha-BHC (1)		ND	ND													0.3 C
delta-BHC (1)		ND	ND													—
gamma-BHC (Lindane)	1.00	ND	3.00E-04	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	2114	1.5 C
Heptachlor	1.00	ND	5.00E-04	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	3524	0.4 C
Aldrin	1.00	ND	3.00E-04	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	2114	0.11 C

TABLE 2-3b

RBC CALCULATIONS FOR THE OCCUPATIONAL WORKER SCENARIO

NONCARCINOGENIC

	Target HI	Inhalation RfD (mg/kg-d)	Oral RfD (mg/kg-d)	Body Weight (kg)	Avg. Time (y)	Exp. Freq. (d/y)	Exp. Dur. (y)	Vol. Factor (m^3/kg)	Particle Emission Factor (m^3/kg)	Ingestion Rate (Soil) (mg/d)	Inhalation Rate (Air) (m^3/d)	Contact Rate (kg/d)	Matrix Effect	Fraction Contacted	RBC (mg/kg)	
Dieldrin	1.00	ND	5.00E-05	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	352	—
Heptaclor epoxide	1.00	ND	1.35E-05	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	95	0.2 C
4,4'DDT	1.00	ND	5.00E-04	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	3524	7.9 C
Endosulfan I (1)		ND	ND													
Endrin	1.00	ND	3.00E-04	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	2114	
Endosulfan II(1)		ND	ND													
Endosulfan Sulfate (1)		ND	ND													34 N
Chlordane	1.00	ND	6.00E-05	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	423	1.5 C
Methoxychlor	1.00	ND	5.00E-03	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	35241	—
Endrin Aldehyde (1)		ND	ND													
SEMIVOLATILE																
Phenol	1.00	ND	6.00E-01	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	4228966	
2-Methylphenol	1.00	ND	5.00E-02	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	352414	
4-Methylphenol	1.00	ND	5.00E-03	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	35241	
2,4-Dimethylphenol	1.00	ND	2.00E-02	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	140966	
2,4-Dichlorophenol	1.00	ND	3.00E-03	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	21145	
Anthracene	1.00	ND	3.00E-01	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	2114483	19 S
Pyrene	1.00	ND	3.00E-02	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	211448	20,000 N
Naphthalene	1.00	ND	4.00E-02	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	281931	800 S
Acenaphthylene (1)		ND	ND													
Acenaphthene	1.00	ND	6.00E-02	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	422897	
Diethylphthalate	1.00	ND	8.00E-01	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	5638621	
Fluorene	1.00	ND	4.00E-02	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	281931	300 S
Fluoranthene	1.00	ND	4.00E-02	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	281931	27,000 N
Benzo(g,h,i)perylene (1)	1.00	ND	ND													
Bis(2-ethylhexyl)phthalate	1.00	ND	2.00E-02	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	140966	
Di-n-butylphthalate	1.00	ND	1.00E-01	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	704828	
Di-n-octylphthalate	1.00	ND	2.00E-02	70	25	250	25	0	4.63E+09	50	20	4.00E-06	0.50	0.50	140966	
2-Methylnaphthalene (1)		ND	ND													
Dibenzofuran (1)		ND	ND													
Phenanthrene (1)		ND	ND													

left out BAA, BAP & other carcinogenic PAHs

TABLE 2-4a

RBC CALCULATIONS FOR THE RECREATIONAL USER SCENARIO

CARCINOGENIC

	Target HI	Inhalation Slope Factor 1/(mg/kg-d)	Oral Slope Factor 1/(mg/kg-d)	Body Weight (kg)	Averaging Time (y)	Exposure Frequency (d/y)	Exposure Duration (y)	Vol. Factor (m^3/kg)	Particle Emission Factor (m^3/kg)	Ingestion Rate (Soil) (mg/d)	Inhalation Rate (Air) (m^3/d)	Contact Rate (kg/d)	Matrix Effect	Fraction Contacted	RBC (mg/kg)
METAL															
Arsenic	1.00E-06	1.50E+01	1.75E+00	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	1.77E+01
Beryllium	1.00E-06	8.40E+00	4.30E+00	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	7.21E+00
Lead (1)		ND	ND												
Chromium VI	1.00E-06	4.10E+01	0.00E+00	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	2.33E+04
Cadmium	1.00E-06	6.10E+00	ND	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	1.57E+05
VOLATILE															
Benzene	1.00E-06	2.90E-02	2.90E-02	14.5	70	32	7	2.11E+04	4.63E+09	200	16	6.64E-06	0.50	0.50	1.32E+02
Methylene chloride	1.00E-06	1.60E-03	7.50E-03	14.5	70	32	7	4.25E+02	4.63E+09	200	16	6.64E-06	0.50	0.50	5.42E+01
Tetrachloroethene	1.00E-06	1.80E-03	5.00E-03	14.5	70	32	7	3.73E+03	4.63E+09	200	16	6.64E-06	0.50	0.50	4.01E+02
Trichloroethene	1.00E-06	6.00E-03	1.10E-02	14.5	70	32	7	3.53E+03	4.63E+09	200	16	6.64E-06	0.50	0.50	1.17E+02
SEMIVOLATILE															
Benzo(a)anthracene	1.00E-06	8.80E-01	1.06E+00	14.5	70	32	7	0	4.63E+09	200	16	0.00E+00	0.50	0.50	3.12E+01
Benzo(a)pyrene	1.00E-06	6.10E+00	7.30E+00	14.5	70	32	7	0	4.63E+09	200	16	0.00E+00	0.50	0.50	4.53E+00
Benzo(b)fluoranthene	1.00E-06	8.50E-01	1.02E+00	14.5	70	32	7	0	4.63E+09	200	16	0.00E+00	0.50	0.50	3.24E+01
Benzo(k)fluoranthene	1.00E-06	4.80E-01	4.00E-01	14.5	70	32	7	0	4.63E+09	200	16	0.00E+00	0.50	0.50	8.27E+01
Bis(2-ethylhexyl)phthalate	1.00E-06	ND	1.40E-02	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	2.22E+03
Indeno(1,2,3-cd)pyrene	1.00E-06	1.42E+00	1.69E+00	14.5	70	32	7	0	4.63E+09	200	16	0.00E+00	0.50	0.50	1.96E+01
N-Nitrosodiphenylamine	1.00E-06	ND	4.90E-03	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	6.33E+03
Chrysene	1.00E-06	2.70E-02	3.20E-02	14.5	70	32	7	0	4.63E+09	200	16	0.00E+00	0.50	0.50	1.03E+03
Dibenzo(a,h)anthracene	1.00E-06	6.77E+00	8.10E+00	14.5	70	32	7	0	4.63E+09	200	16	0.00E+00	0.50	0.50	4.08E+00
N-nitrosodi-n-propylamine	1.00E-06	ND	7.00E+00	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	4.43E+00
PESTICIDE/PCB															
Chlordane	1.00E-06	1.30E+00	1.30E+00	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	2.39E+01
Aroclors (PCBs)(2)	1.00E-06	ND	7.70E+00	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	4.03E+00
4,4'DDT	1.00E-06	3.40E-01	3.40E-01	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	9.12E+01
4,4'DDE	1.00E-06	ND	3.40E-01	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	9.12E+01
4,4'DDD	1.00E-06	ND	2.40E-01	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	1.29E+02
Heptachlor	1.00E-06	4.50E+00	4.50E+00	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	6.89E+00
Heptachlor epoxide	1.00E-06	9.10E+00	9.10E+00	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	3.41E+00
Dieldrin	1.00E-06	1.60E+01	1.60E+01	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	1.94E+00
gamma-BHC	1.00E-06	ND	1.30E+00	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	2.39E+01
beta-BHC	1.00E-06	1.80E+00	1.80E+00	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	1.72E+01
Aldrin	1.00E-06	ND	1.70E+01	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	1.82E+00
Gasoline	1.00E-06	ND	1.70E-03	14.5	70	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	1.82E+04

TABLE 2-4a

RBC CALCULATIONS FOR THE RECREATIONAL USER SCENARIO

Notes:
Target HI = Target Hazard Index; Hazard Index <1.00 for noncarcinogens indicates no expected adverse health effects; target risk is 1 x 10^-6
Inhalation and oral RfDs: EPA provisional values from EPA's IRIS database and HEAST (EPA 1992, 1993)
Body weight and averaging time = standard EPA values (EPA 1989)
Exposure frequency and duration = assumed values
Fraction contacted and matrix effect = assumed values
Soil Ingestion Rate = standard intake of 200 mg/d for an 8-hour day
Air Inhalation Rate = standard intake rate of 16 m^3/d for an 8-hour day
Soil Contact Rate = RME dermal contact rate based on exposed surface area (33200 cm^2)*adherence factor (0.5 mg/cm^2)*absorbed fraction (0.01).
Volatilization Factor = Chemical-specific measure of the quantity of a chemical that will volatilize from soil (EPA 1991).
Particle Emission Factor = EPA standard default value; measure of dust production from wind erosion (EPA 1991).
NA = not applicable
ND = no data
(1) These chemicals do not have inhalation or oral RfD values; therefore, RBCs could not be calculated.
(2) Aroclors = Aroclor 1016, 1221, 1232, 1242, 1248, and 1254.

RBC = (THI*BW*AT*365d/y)/{FC*EF*ED((1/RfDo*ME*IngR*10^-6)+(1/RfDo*CR)+(1/RfDi*InhR(1/VF+1/PEF)))} (Noncarcinogenic chemicals)
RBC=(TR*BW*AT*365d/y)/{FC*EF*ED((SFo*ME*IngR*10^-6)+(SFo*CR)+(SFi*InhR(1/VF+1/PEF)))} (Carcinogenic chemicals)

TABLE 2-4b

RBC CALCULATIONS FOR THE RECREATIONAL USER SCENARIO

NONCARCINOGENIC

	Target HI	Inhalation RfD (mg/kg-d)	Oral RfD (mg/kg-d)	Body Wgt. (kg)	Avg. Time (y)	Exp. Freq. (d/y)	Exp. Dur. (y)	Vol. Factor (m^3/kg)	Particle Emission Factor (m^3/kg)	Ingestion Rate (Soil) (mg/d)	Inhalation Rate (Air) (m^3/d)	Contact Rate (kg/d)	Matrix Effect	Fraction Contacted	RBC (mg/kg)
METAL**															
Antimony	1.00	ND	4.00E-04	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	1241
Arsenic	1.00	ND	3.00E-04	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	931
Barium	1.00	1.40E-04	7.00E-02	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	213667
Beryllium	1.00	ND	5.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	15509
Cadmium (food)	1.00	ND	1.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	3102
Chromium III	1.00	ND	1.00E+00	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	3101850
Chromium (VI)	1.00	ND	5.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	15509
Copper	1.00	ND	3.70E-02	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	114768
Lead (1)		ND	ND												
Manganese	1.00	1.14E-04	5.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	15487
Mercury	1.00	3.00E-04	3.00E-04	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	931
Nickel	1.00	ND	2.00E-02	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	62037
Silver	1.00	ND	5.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	15509
Selenium	1.00	ND	5.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	15509
Thallium (as Thallic oxide)	1.00	ND	7.00E-05	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	217
Vanadium	1.00	ND	7.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	21713
Zinc	1.00	ND	3.00E-01	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	930555
VOLATILE															
Methylene chloride	1.00	8.60E-01	6.00E-02	14.5	7	32	7	4.25E+02	4.63E+09	200	16	6.64E-06	0.50	0.50	7261
Acetone	1.00	ND	1.00E-01	14.5	7	32	7	8.82E+03	4.63E+09	200	16	6.64E-06	0.50	0.50	310185
2-Butanone	1.00	2.86E-01	5.00E-02	14.5	7	32	7	1.09E+04	4.63E+09	200	16	6.64E-06	0.50	0.50	45497
Ethylbenzene	1.00	2.90E-01	1.00E-01	14.5	7	32	7	1.39E+04	4.63E+09	200	16	6.64E-06	0.50	0.50	65688
Toluene	1.00	1.10E-01	2.00E-01	14.5	7	32	7	6.71E+03	4.63E+09	200	16	6.64E-06	0.50	0.50	14893
Xylene (total)	1.00	ND	2.00E+00	14.5	7	32	7	4.03E+03	4.63E+09	200	16	6.64E-06	0.50	0.50	6203699
Tetrachloroethene	1.00	ND	1.00E-02	14.5	7	32	7	3.73E+03	4.63E+09	200	16	6.64E-06	0.50	0.50	31018
PESTICIDE/PCB															
alpha-BHC (1)		ND	ND												
delta-BHC (1)		ND	ND												
gamma-BHC (Lindane)	1.00	ND	3.00E-04	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	931
Heptachlor	1.00	ND	5.00E-04	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	1551
Aldrin	1.00	ND	3.00E-04	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	931

TABLE 2-4b

RBC CALCULATIONS FOR THE RECREATIONAL USER SCENARIO

NONCARCINOGENIC

	Target HI	Inhalation RfD (mg/kg-d)	Oral RfD (mg/kg-d)	Body Wgt. (kg)	Avg. Time (y)	Exp. Freq. (d/y)	Exp. Dur. (y)	Vol. Factor (m^3/kg)	Particle Emission Factor (m^3/kg)	Ingestion Rate (Soil) (mg/d)	Inhalation Rate (Air) (m^3/d)	Contact Rate (kg/d)	Matrix Effect	Fraction Contacted	RBC (mg/kg)
Dieldrin	1.00	ND	5.00E-05	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	155
Heptachlor epoxide	1.00	ND	1.35E-05	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	42
4,4'DDT	1.00	ND	5.00E-04	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	1551
Endosulfan I (1)		ND	ND												
Endrin	1.00	ND	3.00E-04	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	931
Endosulfan II (1)		ND	ND												
Endosulfan sulfate (1)		ND	ND												
Chlordane	1.00	ND	6.00E-05	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	186
Methoxychlor	1.00	ND	5.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	15509
Endrin aldehyde (1)		ND	ND												
SEMIVOLATILE															
Phenol	1.00	ND	6.00E-01	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	1861110
2-Methylphenol	1.00	ND	5.00E-02	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	155092
4-Methylphenol	1.00	ND	5.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	15509
2,4-Dimethylphenol	1.00	ND	2.00E-02	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	62037
2,4-Dichlorophenol	1.00	ND	3.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	9306
Anthracene	1.00	ND	3.00E-01	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	930555
Pyrene	1.00	ND	3.00E-02	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	93055
Naphthalene	1.00	ND	4.00E-02	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	124074
Acenaphthylene (1)		ND	ND												
Acenaphthene	1.00	ND	6.00E-02	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	186111
Diethylphthalate	1.00	ND	8.00E-01	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	2481480
Fluorene	1.00	ND	4.00E-02	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	124074
Fluoranthene	1.00	ND	4.00E-02	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	124074
Benzo(g,h,i)perylene	1.00	ND	ND	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06			
Bis(2-ethylhexyl)phthalate	1.00	ND	2.00E-02	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	62037
Di-n-butylphthalate	1.00	ND	1.00E-01	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	310185
Di-n-octylphthalate	1.00	ND	2.00E-02	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	62037
2-Methylnaphthalene (1)		ND	ND												
Dibenzofuran (1)		ND	ND												
Phenanthrene (1)		ND	ND												

TABLE 2-4b

RBC CALCULATIONS FOR THE RECREATIONAL USER SCENARIO

NONCARCINOGENIC

	Target HI	Inhalation RfD (mg/kg-d)	Oral RfD (mg/kg-d)	Body Wgt. (kg)	Avg. Time (y)	Exp. Freq. (d/y)	Exp. Dur. (y)	Vol. Factor (m^3/kg)	Particle Emission Factor (m^3/kg)	Ingestion Rate (Soil) (mg/d)	Inhalation Rate (Air) (m^3/d)	Contact Rate (kg/d)	Matrix Effect	Fraction Contacted	RBC (mg/kg)
PETROLEUM HYDROCARBON															
as #2 Diesel	1.00	ND	8.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	24815
as Gasoline--Regular	1.00	ND	2.00E-01	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	620370
as Various Petroleums	1.00	ND	8.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	24815
as Fluids (2)	1.00	ND	8.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	24815
as #2 Fuel Oil	1.00	ND	8.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	24815
as #1 Fuel Oil	1.00	ND	8.00E-03	14.5	7	32	7	0	4.63E+09	200	16	6.64E-06	0.50	0.50	24815

**Al, Ca, Mg, K, Fe, Na usually not considered chemicals of concern

Notes:

Target HI = Target Hazard Index; Hazard Index <1.00 for noncarcinogens indicates no expected adverse health effects; target risk is 1 x 10^-6

Inhalation and oral RfDs: EPA provisional values from EPA's IRIS database and HEAST (EPA 1992, 1993)

Body weight and averaging time = standard EPA values (EPA 1989)

Exposure frequency and duration = assumed values

Fraction contacted and matrix effect = assumed values

Soil Ingestion Rate = standard intake of 200 mg/d for an 8-hour day

Air Inhalation Rate = standard intake rate of 16 m^3/d for an 8-hour day

Soil Contact Rate = RME dermal contact rate based on exposed surface area (33200 cm^2)*adherence factor (0.5 mg/cm^2)*absorbed fraction (0.01).

Volatilization Factor = Chemical-specific measure of the quantity of a chemical that will volatilize from soil (EPA 1991).

Particle Emission Factor = EPA standard default value; measure of dust production from wind erosion (EPA 1991).

NA = not applicable

ND = no data

(1) These chemicals do not have inhalation or oral RfD values; therefore, RBCs could not be calculated.

(2) Fluids - brake, hydraulic, and transmission fluid.

RBC = (THI*BW*AT*365d/y)/{FC*EF*ED((1/RfDo*ME*IngR*10^-6)+(1/RfDo*CR)+(1/RfDi*InhR(1/VF+1/PEF)))} (Noncarcinogenic chemicals)

RBC=(TR*BW*AT*365d/y)/{FC*EF*ED((SFo*ME*IngR*10^-6)+(SFo*CR)+(SFi*InhR(1/VF+1/PEF)))} (Carcinogenic chemicals)

TABLE 2-5

REFERENCE DOSES FOR NONCARCINOGENIC CHEMICALS OF CONCERN

Chemical	Noncarcinogenic RfD (mg/kg/d)				Uncertainty Factor		Confidence Level	Critical Effect	Species/Experiment Length/Target Organ
	Inhalation	Source	Oral	Source	Inhal	Oral			
Acenaphthene Chronic	ND		6×10^{-2}	1		3000		Liver toxicity	Mouse, 175 mg/kg/day, gavage, 90 days
Acetone Chronic	ND		1×10^{-1}	1	NA	1000	Low	Increased liver/kidney weight, nephrotoxicity	Rat, 100 mg/kg/day oral gavage, 90 days; liver/kidney.
Aldrin Chronic	ND		3×10^{-5}	1	NA	1000	Medium	Liver toxicity	Rat, 0.025 mg/kg/d for 2 years, liver.
Anthracene Chronic	ND		3×10^{-1}	1	NA	3000	Low	None observed	Mouse, 1,000 mg/kg/d, 90 days.
Antimony Chronic	ND		4×10^{-4}	1	NA	1000	Low	Increased mortality, altered chemistries.	Mouse, 0.35 mg/kg/day, lifetime
Arsenic (Inorganic) Chronic*	ND		3×10^{-4}	1	NA	3	Medium	Skin keratosis and hyperpigmentation, possible vascular complications	Human, 0.009 mg/L oral; skin.
Barium Chronic	1.4×10^{-4}	4	7×10^{-2}	1	1000	3	Medium	Increased blood pressure; fetotoxicity	Human, 0.21 mg/kg/d, 10 weeks, oral; cardiovascular system; rat, 0.8 mg/m^3, inhalation, 4 months.
Beryllium Chronic*	ND		5×10^{-3}	1	NA	100	Low	None observed	Rat, 0.54 mg/kg/d, oral drinking water, lifetime.
2-Butanone (Methyl ethyl ketone) Chronic	1×10^{0}	1	6×10^{-1}	1	1000	3000	Low	Decreased fetal birth weight	Mouse, 2978 mg/m^3 for 11 days (gestational), fetus; rat, 1771 mg/kg/d for lifetime, drinking water, fetus.
Cadmium Chronic*	ND		5×10^{-4} (water) 1×10^{-3} (food)	1 1	1		High	Kidney damage, significant proteinuria	Human, 0.055 mg/kg/d - water, 0.01 mg/kg/d - food; chronic exposure, kidney.

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8 HEAST 1992 - Converted from 1.3 mg/L.
9 RfD values for diesel fuel were used for various petroleums, brake, hydraulic, transmission fluid, #1 fuel oil, and #2 fuel oil in the RBC calculations.
10 EPA 1992. Oral Reference Doses and Oral Slope Factors for JP-4, JP-5, Diesel Fuel, and Gasoline. From Joan S. Dollarhide, Superfund Health Risk Technical Support Center to Carol Sweeney. USEPA Region X.

TABLE 2-5

REFERENCE DOSES FOR NONCARCINOGENIC CHEMICALS OF CONCERN (continued)

Chemical	Noncarcinogenic RfD (mg/kg/d)				Uncertainty Factor		Confidence Level	Critical Effect	Species/Experiment Length/Target Organ
	Inhalation	Source	Oral	Source	Inhal	Oral			
Chlordane Chronic*	ND		6×10^{-5}	1	NA	1000	Low	Regional liver hypertrophy in females	Rat, 0.055 mg/kg/d, oral 30 months; liver.
Chromium III Chronic	ND		1×10^{0}	1	NA	1000	Low	None observed	Rat, 5% diet, 840 days
Copper Chronic	ND		3.7×10^{-2}	9	NA			Intestinal irritation	Human, 5.3 mg oral, single dose; gastrointestinal system.
p-Cresol (4-Methyl phenol) Chronic	ND	5	5×10^{3}	2,6		1000		Decreased weight gain, neurotoxicity	Rat, 50 mg/kg/d oral gavage, 90 days; whole body, nervous system
4,4-DDT Chronic*	ND		5×10^{-4}	1	NA	100	Medium	Liver lesions	Rats, 0.05 mg/kg/d oral, 27 weeks; liver.
Diesel fuel(9) Chronic	ND		8×10^{-3}	7	NA	10,000	Medium	Fatty changes in liver, hyaline droplet nephropathy	Mouse, 50 mg/m^3, inhalation; kidney, liver
2,4-Dichlorophenol Chronic	ND	1	3×10^{-3}	1	NA	100	Low	Decreased delayed hypersensitivity response	Rat, 0.3 mg/kg/d for 15 weeks, drinking water, immune system.
2,4-Dimethylphenol Chronic	ND	1	2×10^{-2}	1	NA	3000	Low	Clinical signs (lethargy, prostration, and ataxia) and hematological changes.	Mouse, 50 mg/kg/d for 90 days, oral gavage, nervous system and blood.
Di-n-butylphthalate Chronic	ND	5	1×10^{-1}	1	NA	1000	Low	Increased mortality; fetotoxicity, degeneration of seminiferous tubules	Rat, 125 mg/kg/day, oral, 52 weeks, whole body Mice, 2100 mg/kg/day, oral, throughout gestation.

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TABLE 2-5

REFERENCE DOSES FOR NONCARCINOGENIC CHEMICALS OF CONCERN (continued)

Chemical	Noncarcinogenic RfD (mg/kg/d)				Uncertainty Factor		Confidence Level	Critical Effect	Species/Experiment Length/Target Organ
	Inhalation	Source	Oral	Source	Inhal	Oral			
Diethyl phthalate Chronic	ND		8×10^{-1}	1	NA	1000	Low	Decreased growth rate, food consumption and altered organ weights.	Rat, 750 mg/k/d, diet, 2-16 wk, brain, heart, spleen, kidney.
Dieldrin Chronic*	ND		5×10^{-5}	1	NA	100	Medium	Liver lesions	Rat, 0.005 mg/kg/d diet, 2 years; liver.
Di-n-octyl phthalate Chronic	ND		2×10^{-2}	3	NA	1000		Kidney - increased weight; liver - increased weight, serum glutamic oxaloacetic transaminase and serum glutamic pyruvic transaminase activity	Rat, 175 mg/kg/d diet, 7-12 months; kidney, liver.
Endrin Chronic	ND	1	3×10^{-4}	1	NA	100	Medium	Mild histological lesions in liver, occasional convulsions	Dog, 0.025 mg/kg/d for 2 years, diet, liver.
Ethylbenzene Chronic	2.9×10^{-1}	1	1×10^{-1}	1	300	1000	Low	Developmental toxicity; liver/kidney toxicity	Rabbit, rat, 434 mg/m^3 intermittent inhalation; rabbit-24 days, rat-19 days; fetus; rat, 97.1 mg/kg/d, diet, 182 days; liver, kidney
Fluoranthene Chronic	ND		4×10^{-2}	1	NA	3000	Low	Kidney - nephropathy; liver - increased weight; blood - hematological changes	Mouse, 125 mg/kg/d oral gavage, 90 days; kidney, liver, blood.
Fluorene Chronic	ND		4×10^{-2}	1	NA	3000		Blood - decreased red blood cells	Mouse, 125 mg/kg/day, gavage, 13 weeks
Gasoline (unleaded) Chronic*	ND		2×10^{-1}	7	NA		Low	CNS effects, hyaline droplet nephropathy	Rat and mouse, 230 mg/m^3 for 3-6 months; kidney
Heptachlor Chronic	ND		5×10^{-4}	1	NA	300	Low	Increased weight of liver (males)	Rat, 0.15 mg/kg/d diet, 2 years; liver.

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TABLE 2-5

REFERENCE DOSES FOR NONCARCINOGENIC CHEMICALS OF CONCERN (continued)

Chemical	Noncarcinogenic RfD (mg/kg/d)				Uncertainty Factor		Confidence Level	Critical Effect	Species/Experiment Length/Target Organ
	Inhalation	Source	Oral	Source	Inhal	Oral			
Heptachlor epoxide Chronic*	ND		1.3×10^{-5}	1	NA	1000	Low	Increased relative weight of liver	Dog, 0.0125 mg/kg/d diet, 60 weeks; liver.
gamma-Hexachlorocyclohexane (BHC) Chronic*	ND	3	3×10^{-4}	1	NA	1000		Liver and kidney toxicity	Rats, varying amounts, diet, 12 weeks, liver and kidney.
Lead Chronic*	ND		ND		NA	NA	Low	Altered blood enzyme levels; altered neurobehavioral development - children	
Manganese Chronic	4×10^{-4}	1	5×10^{-3}	1	100	1	Medium	Increased prevalence of respiratory symptoms and psychomotor disturbances. CNS effects.	Human, 0.06 mg/kg/d, water, nervous system; human, 0.97 mg/m^3 for 1-19 years,inhalation, respiratory and nervous systems.
Mercury Chronic	8.6×10^{-5}	2	3×10^{-4}	3,6	30	1000	Low	Neurotoxicity. Kidney effects	Human, 0.009 mg/m^3, intermittent inhalation, nervous system; Rat, parenteral, kidney.
Methoxychlor Chronic	ND		5×10^{-3}	1	NA	1000	Low	Excessive loss of litters.	Rabbit, 5.01 mg/kg/d for 12 days, oral gavage, fetus.
2-Methylphenol Chronic*	ND	1	5×10^{-2}	1	NA	1000	Medium	Decreased body weights and neurotoxicity.	Rat, 600 mg/kg/d for 90 days, oral gavage, kidney and CNS.
Naphthalene Chronic	ND		4×10^{-2}	3	NA	1000		Decreased weight	Rat, 50 mg/kg/d oral gavage, 13 weeks; whole body.
Nickel Chronic	ND		2×10^{-2}	1	NA	300	Medium	Decreased body and organ weight	Rat, 100 ppm, diet 2 years; whole body, major organs.

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TABLE 2-5

REFERENCE DOSES FOR NONCARCINOGENIC CHEMICALS OF CONCERN (continued)

Chemical	Noncarcinogenic RfD (mg/kg/d)				Uncertainty Factor		Confidence Level	Critical Effect	Species/Experiment Length/Target Organ
	Inhalation	Source	Oral	Source	Inhal	Oral			
Phenols Chronic	ND	5	6×10^{-1}	1	NA	100	Low	Decreased fetal weight	Rat, 60 mg/kg/day oral gavage, exposure during days 6-15 of gestation; fetus.
Pyrene Chronic	ND		3×10^{-2}	1	NA	3000	Low	Renal tubular pathology, decreased kidney weight	Mouse, 75 mg/kg/d oral gavage, 13 weeks, kidney.
Selenium Chronic	ND		5×10^{-3}	1		3		Clinical selenosis	Human, 0.853 mg/d diet; whole body.
Silver Chronic	ND		5×10^{-3}	1		3	Medium	Argyria	Human, 0.014 mg/kg, oral, 2 to 9 years; skin
Tetrachloroethene Chronic	ND		1×10^{-2}	1	NA	1000	Low	Hepatotoxicity, increased liver weight	Rats, mice, 100-1000 mg/kg/d, oral, gavage, 6 weeks.
Thallic oxide Chronic	ND		7×10^{-5}	2,6		3000	Low	Blood, increased serum glutamic oxaloacetic transaminase, increased serum lactate dehydrogenase	Rat, 0.22 mg/kg/day, oral, gavage, 90 days, liver.
Toluene Chronic	1.1×10^{-1}	1	2×10^{-1}	1	300	1000	Medium	Liver/kidney altered weight; CNS neurological effects; eyes/nose irritation	Rats, 223 mg/kg/d oral gavage, 13 weeks, liver, kidney; human, 40 ppm inhalation; human, 80 ppm, inhalation, CNS, eyes, nose
Vanadium Chronic	ND		7×10^{-3}	2		100		None observed	Rat, 5 ppm, drinking H_2O, lifetime.
Xylenes Chronic	ND	5	2×10^{0}	1		100	Medium	Decreased weight, hyperactivity, increased mortality (males)	Rat, 500 mg/kg/d oral gavage, 13 weeks, whole body.
Zinc (metallic) Chronic	ND		3×10^{-1}	1		3	Medium	Anemia	Human, 2.14 mg/kg/d, oral, blood.

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TABLE 2-6

SLOPE FACTORS FOR CARCINOGENIC CHEMICALS OF CONCERN

Chemical	Carcinogenic Slope Factor $(mg/kg\text{-}d)^{-1}$				EPA Class	Critical Effect	Species/Experiment Length/Target Organs
	Inhalation	Source	Oral	Source			
Arsenic (inorganic)	1.5×10^{1}	5	1.75×10^{0}	5	A	Lung cancer; skin cancer	Human, inhalation, occupational, respiratory system; human, oral, skin
Benzene	2.9×10^{-2}	1	2.9×10^{-2}	1	A	Leukemia (nonlymphocytic)	Human, inhalation, occupational; blood
Benzo(a)anthracene	8.8×10^{-1}	4	1.06×10^{0}	4	B2		
Benzo(a)pyrene	6.1	4	7.3×10^{0}	1,4	B2	Forestomach neoplasia, respiratory neoplasia	Oral - rat, mouse, diet; GI tract; inhalation - hamster, 96.4 weeks (intermittent); respiratory tract
Benzo(b)fluoranthene	8.5×10^{-1}	4	1.02×10^{0}	4	B2	Tumors	Mice
Benzo(k)fluoranthene	4.0×10^{-1}	4	4.8×10^{-1}	4	B2		
Benzo(g,h,i)perylene	1.6×10^{-1}	4	1.3×10^{-1}	4			
Beryllium	8.4×10^{0}	1	4.3×10^{0}	1	B2	Lung cancer	Human, inhalation, occupational; lungs
bis(2-Ethylhexyl)phthalate	ND		1.4×10^{-2}	1	B2	Liver carcinoma, adenoma	Rat, oral, diet, 103 weeks; liver
alpha-BHC (Lindane)		1	6.3×10^{0}	1	B2	Liver carcinoma	Mouse, drinking water, 24 weeks; liver
beta-BHC (Lindane)	1.8×10^{0}	1	1.8×10^{0}	1	C	Liver neoplasia	Mouse, diet, 110 weeks; liver
gamma-BHC (lindane)		1	1.3×10^{0}		C	Liver neoplasia	Mouse, diet, 110 weeks; liver
Cadmium	6.1×10^{0}	1	ND		B1	Respiratory system neoplasia	Human, inhalation, occupational; respiratory system
Chlordane	1.3×10^{0}	1	1.3×10^{0}	1	B2	Carcinoma	Mouse, oral, diet; liver
Chromium (VI)	41	2	ND		A	Respiratory system neoplasia	Human, inhalation, occupational; respiratory system
Chrysene	2.7×10^{-2}	4	3.2×10^{-2}	4	B2		

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2 HEAST 1993
3 ICF - Clement Associates 1988 (Chemical-specific potency factor x benzo(a)pyrene slope factor).
4 HEAST 1991 - Withdrawn from IRIS. Under review.
5 Calculated from Unit Risk, see IRIS.
6 EPA 1991. Oral Reference Doses and Oral Slope Factors for JP-4, JP-5, Diesel Fuel, and Gasoline. From Joan S. Dollarhide, Superfund Health Risk Technical Support Center to Carol Sweeney. USEPA Region X.

TABLE 2-6

SLOPE FACTORS FOR CARCINOGENIC CHEMICALS OF CONCERN (Continued)

Chemical	Carcinogenic Slope Factor $(mg/kg\text{-}d)^{-1}$				EPA Class	Critical Effect	Species/Experiment Length/Target Organs
	Inhalation	Source	Oral	Source			
4,4-DDD	ND		2.4×10^{-1}	1	B2	Thyroid neoplasia	Mouse, 250 ppm diet, 130 weeks; lungs; rats, both sexes, varying doses in diet, 113 weeks; thyroid (males)
4,4-DDE	ND		3.4×10^{-1}	1	B2	Thyroid and liver carcinoma, neoplasia	Mouse, rat, hamsters, oral; thyroid, liver
4,4-DDT	3.4×10^{-1}	1	3.4×10^{-1}	1	B2	Neoplasia	Mouse, rat, diet; liver
Dibenzo(a,h)anthracene	6.77×10^{0}	4	8.1×10^{0}	4	B2		
Dieldrin	1.6×10^{1}	1	1.6×10^{1}	1	B2	Hepatocellular carcinoma	Mouse, diet; liver
Gasoline (unleaded)	ND		1.7×10^{-3}	6	C	Kidney and liver neoplasms	Mouse, inhalation; liver, kidney, and skin
Heptachlor	4.5	1	4.5	1	B2	Hepatocellular carcinoma	Mouse, diet; liver
Heptachlor epoxide	9.1	1	9.1	1	B2	Hepatocellular carcinoma	Mouse, diet, 18-24 months; liver
Indeno(1,2,3-cd)pyrene	1.42×10^{0}	4	1.69×10^{0}	4	B2		
Lead (inorganic)	ND		ND	1	B2	Bilateral renal carcinoma	Rats, diet; kidney
Methylene chloride (dichloromethane)	1.6×10^{-3}	1	7.5×10^{-3}	1	B2	Neoplasia, leukemia	Mice, rats, drinking water; whole body
2-Methylphenol	ND		ND		C	Skin papillomas	Mice, dermal application, 12 weeks; skin
n-Nitrosodiphenylamine	ND		4.9×10^{-3}	1	B2	Urinary bladder tumors	Rat, dietary, 700 days; bladder
PCB-1254 (Aroclor 1254)	ND		7.7×10^{0}	1	B2	Neptocellular carcinoma	Mice/rats, oral; liver
Tetrachloroethene	1.8×10^{-3}	5	5.0×10^{-2}	5	B2	Leukemia, liver tumors	Rat, inhalation; mouse, gavage
Trichloroethene	6×10^{-3}	5	1.1×10^{-2}	5	B2	Lung and liver tumors	Mice, inhalation, gavage

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TABLE 2-7

BACKGROUND CONCENTRATIONS FOR METALS IN SOILS IN OMAHA

	Omaha Area (1) Elemental Concentrations	Background Samples North of Grace Street (0-1')	(3.5-5')	Critical Background Concentrations
Antimony	<1	ND	ND	ND
Arsenic	10-100	23	17.3	23 (3)
Barium	700	--	--	700 (1)
Beryllium	1-15	1	1.6	1.6 (3)
Cadmium	--	ND	ND	ND
Chromium	70	20	30	30 (3)
Copper	30-700	25.5	169.5	97.5 (3)
Lead	--	98.5	717	<300 (2)
Manganese	200 - 7,000	--	--	7,000(1)
Mercury	0.051-0.13	0.43	0.21	0.32 (3)
Nickel	30-700	21	117	69 (3)
Selenium	0.5-5	ND	1.2	0.6 (3)
Silver	--	0.2	2.3	1.25 (3)
Thallium	--	ND	ND	ND
Vanadium	20-500	--	--	500 (1)
Zinc	10-300	114	705	360 (3)

All concentrations are reported in mg/kg.

ND = Not detected.

-- = No analysis performed for this metal.

(1) Elemental Concentrations in Soils and Other Surficial Materials of the Conterminous United States. USGS Professional Paper 1270. (USGS 1984.)

(2) Douglas County Health Department. Tom Baker.

(3) Where site-specific background data varied by more than a factor of 2 times, the average of the two samples was used as the critical background concentration. Otherwise, the maximum concentration of the background samples taken at the UPRR Omaha Shops was used.

TABLE 2-8

COMPARISON OF SITE METALS CONCENTRATIONS WITH BACKGROUND LEVELS

	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Lead
Critical Background Concentrations	ND	23	700	1.6	ND	30	97.5	300
Acetylene Pit	28	35		0.98	2.5	16	15	690
Babbitt Shop	17	22		1.1	3.9	11	130	810
Wastewater Treatment Area		6.9		0.9	0.3	7.6	86	20
Bearing Shop	11	6.8		0.58	0.5	16	46	83
Blue Building		9.9		0.6	0.4	0.8	262	56
Chemical Storage Area	11	4.3		0.6	0.82	9.8	90	150
Car Demolish Area		21.8		0.8		41	76	212
Car Dismantal Area (East)		4.3		0.9		9	185	13
Car Dismantal Area (West)		20.4		0.5	0.6	4.5	225	103
Car Holding Area		20.9		0.2	0.4	1.8	125	53
Car Shop		4.4		0.3	3.6	4.8	38	11
8th Street Yard (Central)		9.6		0.6		1.5	112	91
8th Street Yard (North)		215		0.4	0.5	1.3	730	403
8th Street Yard (South)		419		0.7	0.7	1.2	605	994
Gas House	11	6.7		0.92	0.75	1.5	1.9	2.3
Grace Street Yard		22.6		1.2		16	66.5	242
Oil Storage Area	21	68		1.2	4.4	12	160	830
Open Drum Storage Area (South)		16.6		1.3		8.5	40.2	111
Open Drum Storage Area (North)		63.4		1.1		30	488	2450
Oil Tank/Pump House Area		3.6		0.62	0.48	18	12	23
Oil & Waste House		7.7		0.68	0.42	20	15	39
Paint Barrel Pits	480	31		0.7	1.5	34	930	7800
Power House		4.5		0.5		1.1	35	7.1
Roundhouse		4.9		0.9	0.2	1.1	10.2	26
Steel Shop		16.4		0.3	0.5	1.8	124	43
Stores Area (East)		7.3		0.7	0.2	1.3	349	49
Stores Area (West)		8.3		0.8	0.1	0.6	218	155
Traction Motor Shop		7.2		0.9	0.3	2	182	50
Temp. Haz. Waste Storage Area		4.7		0.7		0.7	365	50
Wheel Shop		3.7					54	16
Construction Area		300	800	2.4	19	59	400	1800

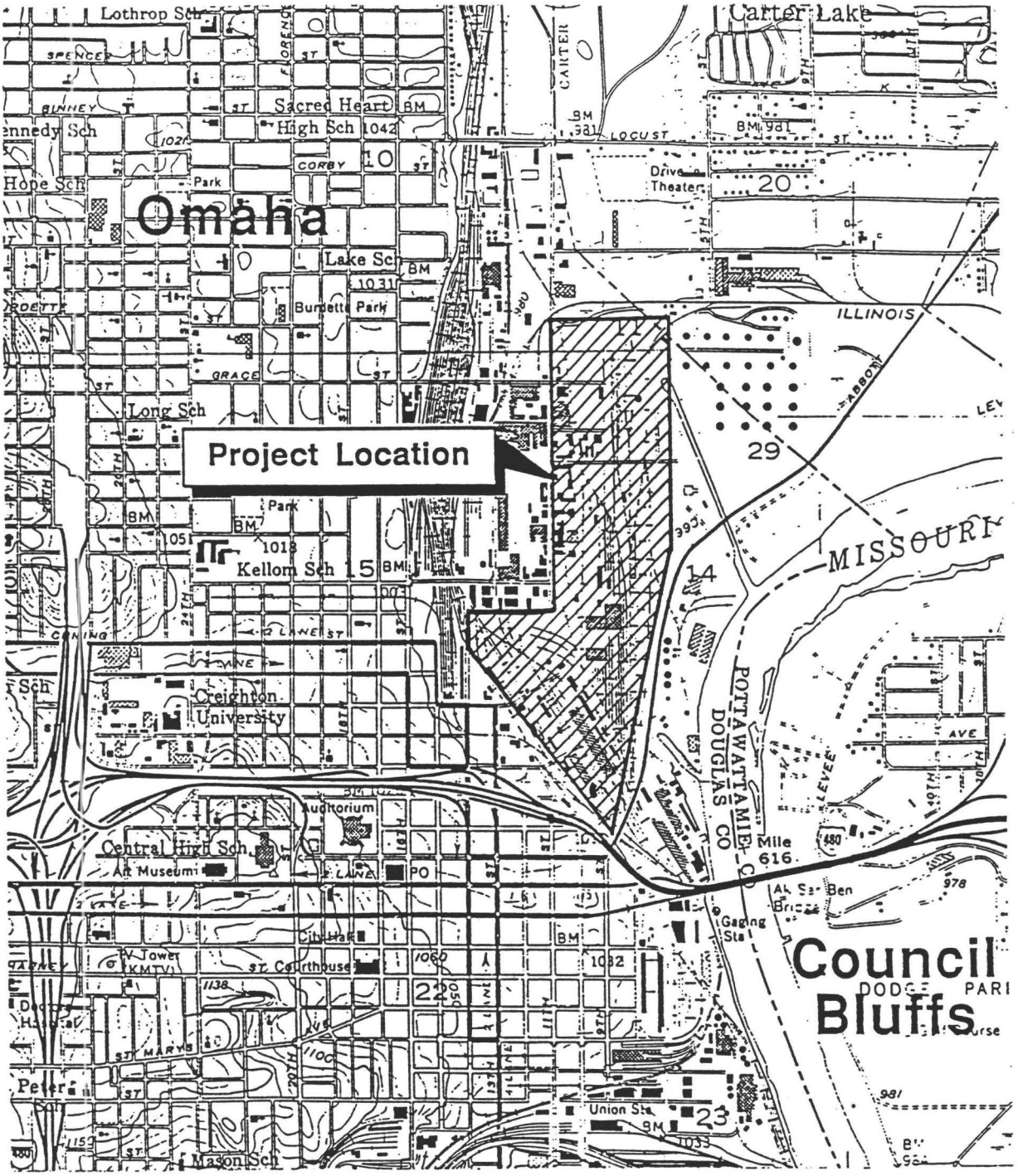
All concentrations are reported in mg/kg.
Shaded concentrations indicate that the concentration is above the critical background concentrations.
Aluminum, calcium, iron, magnesium, potassium, and sodium are not considered chemicals of concern.

TABLE 2-8

COMPARISON OF SITE METALS CONCENTRATIONS WITH BACKGROUND LEVELS

	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Critical Background Concentrations	7000	0.32	69	0.6	1.25	ND	500	360
Acetylene Pit		0.29	17					**730**
Babbitt Shop		**0.73**	16					240
Wastewater Treatment Area		0.2	10		**2**			152
Bearing Shop		0.09	16		0.6			82
Blue Building		**0.4**	24		0.6			293
Chemical Storage Area		0.12	15					120
Car Demolish Area		**0.5**	24.6	**5.9**	0.6			352
Car Dismantal Area (East)		0.2	22		0.7			189
Car Dismantal Area (West)		**2.6**	43		0.8			**613**
Car Holding Area		0.2	19		1			**559**
Car Shop		0.27	21		**1.5**			163
8th Street Yard (Central)		0.3	64		**1.4**			**575**
8th Street Yard (North)		**0.4**	24	**3.6**	**9.7**			**1030**
8th Street Yard (South)		**0.4**	32	**2.9**	**9.8**			**3540**
Gas House		0.03	22					59
Grace Street Yard		0.3	24	**2.7**	0.8			3.59
Oil Storage Area		0.23	21					**960**
Open Drum Storage Area (South)		0.2	7.4	**1.8**	**1.3**			208
Open Drum Storage Area (North)		**0.4**	24.5	**4.3**	**1.7**			**4020**
Oil Tank/Pump House Area		0.13	16					46
Oil & Waste House		0.03	19					56
Paint Barrel Pits			34	**13**		**11**		
Power House		0.2	13		0.2			11
Roundhouse		0.2	10					206
Steel Shop		0.3	17		0.8			315
Stores Area (East)		0.3	24		0.8			356
Stores Area (West)		0.2	13					**2320**
Traction Motor Shop		0.3	23					27.3
Temp. Haz. Waste Storage Area		0.7	15		1			218
Wheel Shop		0.1	4		0.6			98
Construction Area	1100		67	**5.6**	**9.7**		54	20

All concentrations are reported in mg/kg.
Shaded concentrations indicate that the concentration is above the critical background concentrations.
Aluminum, calcium, iron, magnesium, potassium, and sodium are not considered chemicals of concern.



2000 1000 0 2000

SCALE IN FEET

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NOTE: SOURCE OF BASE MAP IS HDR ENGINEERING, INC.

Woodward-Clyde
ENGINEERING & SCIENCES APPLIED
TO THE EARTH & ITS ENVIRONMENT

SITE LOCATION MAP
OMAHA SHOP – UNION PACIFIC RAILROAD
OMAHA, NEBRASKA

DRN BY: SCR	DATE: 02/17/94	PROJECT NO. 91MC204	FIG. NO. 2–1
CHK'D BY:	DATE:		

CAD FILE: WC8X11.DWG 02/14/1994 9:33

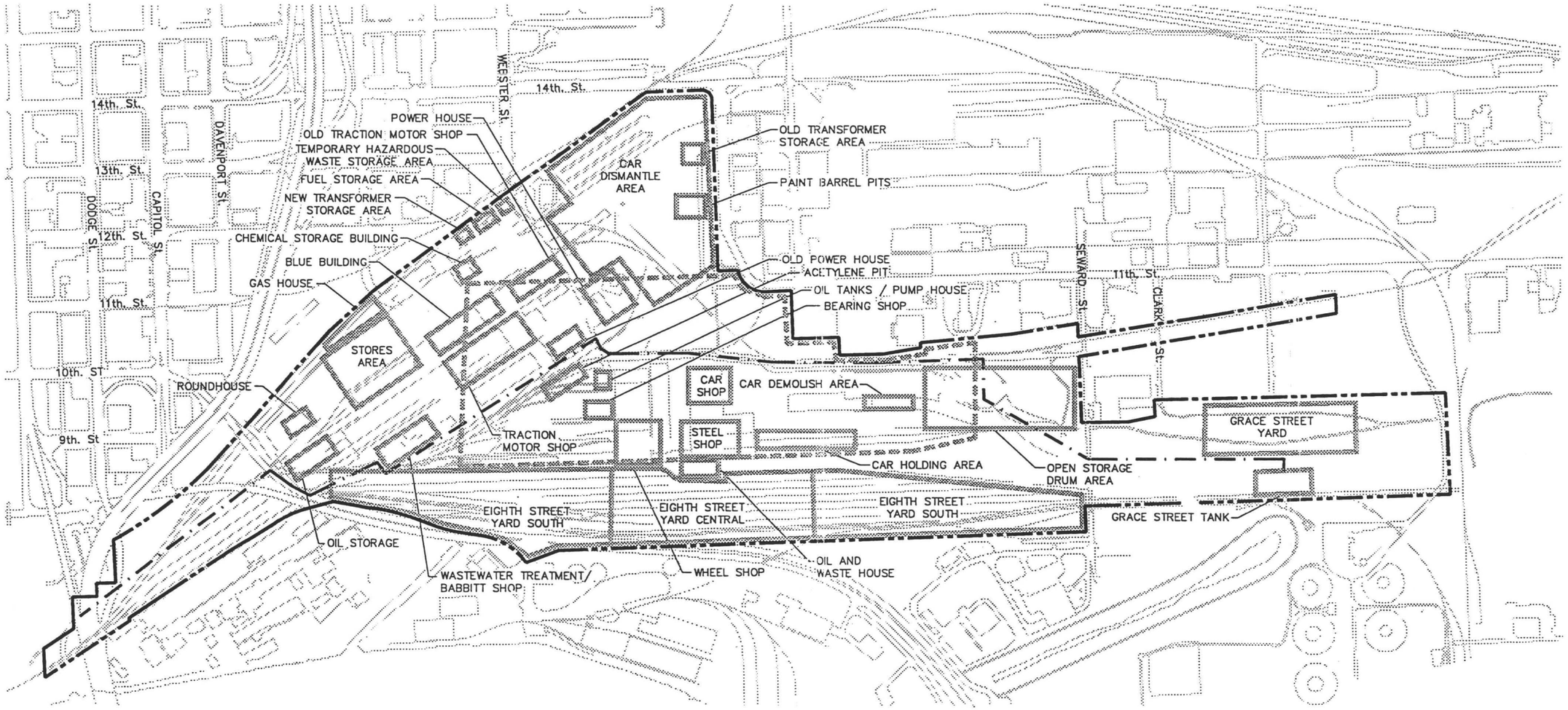
LEGEND

PROPERTY LINE

OIL PIPELINE

HDR STUDY AREAS

CONSTRUCTION AREA



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600 300 0 600

SCALE IN FEET

Woodward-Clyde Consultants

ENGINEERING & SCIENCES APPLIED TO THE EARTH & ITS ENVIRONMENT

SITE PLAN
OMAHA SHOPS
UNION PACIFIC RAILROAD COMPANY

DRN BY CJG	DATE 02/15/94	PROJECT NO. 91MC204	FIG. NO. 2-2
CHK'D BY	REVISION 0		

CAD FILE: 91204BD.DWG 02/16/1994 11:57

3.0
OPERATIONAL AREA INVESTIGATIONS

The field investigation for 30 of the 31 sites was performed by HDR Engineering, Inc. (HDR 1990), and the field investigation for the other site (Construction Area) was performed by W-C (W-C 1992). The following site descriptions and analytical results are taken from these two respective reports.

3.1 OIL STORAGE

The Oil Storage Area is located near the southern boundary of the Omaha Shops. The Oil Storage Area was comprised of a 20,000-gallon tank, located in the service area, south of the locomotive shop. The tank is no longer present. This area was sampled for petroleum hydrocarbons and total metals.

One composite sample was collected, consisting of soils from the surface and bottom of each of three borings (HDR 1990). The sample was analyzed for total metals and petroleum hydrocarbons. Organic vapor analyzer (OVA) readings during sample collection ranged from 100 to 1,000 units in the borehole. Concrete was encountered at zero to 1 foot, with fill, cinders mixed with silty clay and sand, black and very moist soils observed at 1 to 6 feet. One boring was extended to 10 feet; black to greenish-gray soils were observed with a strong petroleum odor. The OVA reading during sample collection was 10 to 20 units from the subsurface soil auger cuttings.

Table 3-1 compares the petroleum hydrocarbons detected and the metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Antimony, arsenic, cadmium, copper, lead, and zinc were reported at concentrations which exceeded the background concentrations for metals in the Omaha area (Table 2-5). Arsenic exceeded the RBCs for the recreational and occupational exposure scenarios by factors ranging from about 4 to 6. Petroleum hydrocarbons as No. 2 fuel oil were detected below RBCs at the site.

Although arsenic exceeded recreational and occupational RBCs, it did so by less than an order of magnitude in each case. It should be noted that the RBCs are very conservative estimates based on reasonable maximum exposures and a target risk of 1×10^{-6}. Actual exposures to soil contamination and resultant risks would be expected to be lower. Furthermore, exceeding the RBC by a factor of 6 would result in a risk of 6×10^{-6}, which is well within the EPA's target risk range of 1×10^{-6} to 1×10^{-4} for risks due to releases at hazardous waste sites (EPA 1991d). Therefore, no significant human health risks would be expected in this area.

3.2 ROUNDHOUSE

The Roundhouse Area is located near the southern boundary of the Omaha Shops. Structurally, all that remains of the Roundhouse Area is the locomotive turntable and foundation remnants. A priority pollutant scan was completed on soil samples collected in this area.

Three borings to a depth of 10 feet each were completed in the Roundhouse Area to collect soil samples (HDR 1990). One composite sample, consisting of soils from the surface and bottom of each of three borings, was collected and analyzed for priority pollutants. The soils did not exhibit visual evidence of discoloration, and OVA readings were less than 2 units above background.

Table 3-2 compares the organic compounds detected and the metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Cadmium was the only metal reported at a concentration which exceeded background concentrations for metals in the Omaha area (Table 2-5); however, cadmium did not exceed any RBCs. Aldrin exceeded the occupational RBCs by less than a factor of 1. However, aldrin may actually be present at concentrations below RBCs because it was co-eluting with delta-BHC during analysis. That is, the concentrations reported for the compounds are the total for both of the co-eluting compounds, and if both compounds are present, the percentages of each are unknown. Therefore, aldrin is not considered to be a chemical of concern at this site.

Because there were no chemical concentrations at the Roundhouse Area which are considered to exceed RBCs, no human health risks would be expected in this area.

3.3 WASTEWATER TREATMENT/BABBITT SHOP

The Wastewater Treatment/Babbitt Shop Area is near the southeastern boundary of the Omaha Shops. The Wastewater Treatment Facility lies over the area where historical yard maps show the Babbitt Shop location. Journal bearings were replaced and serviced in the Babbitt Shop Area for use on locomotives, tenders, passenger, and freight equipment cars. Other possible sources of contamination in the area include an above-ground fuel oil storage tank, concrete wastewater treatment basins, fuel pipeline, pump house, and past fueling activities associated with the locomotive shop.

Five discrete soil samples were collected in the Wastewater Treatment Area (HDR 1990). Samples were collected from the 12-inch to 18-inch-depth interval. The surface of the area sampled appeared to be covered by a gravel fill that was saturated with oil. The five individual samples were each analyzed for metals and petroleum hydrocarbons, and the composite samples were analyzed for metals in view of the high lead, arsenic, and antimony composition of the bearings and bearing lubricants.

At the Babbitt Shop, four borings were drilled, and one composite sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for VOCs, petroleum hydrocarbons, and metals (HDR 1990). The OVA readings in the four boreholes ranged from 600 to 1,000 units. A strong odor was evident at two of the four borings, with green-black, medium stiff soils encountered at 1 to 5 feet in all borings. Asphalt covered each boring, and silty clay mixed with gravel, bricks, and sand were present at 1 to 3 feet.

Table 3-3 compares the organics detected and the metals detected above background at the Babbitt Shop to the RBCs for three exposure scenarios: recreational, occupational, and construction. Antimony, cadmium, copper, lead, and mercury were reported above background level concentrations for metals in the Omaha area (Table 2-5). All organic and inorganic concentrations detected were reported below RBCs; therefore, no human health risks due to exposure to soil in this area would be expected.

Table 3-4 compares the maximum concentrations of the petroleum hydrocarbons detected and the metals detected above background at the Wastewater Treatment Area to the RBCs for three exposure scenarios: recreational, occupational, and construction. Cadmium and silver

were reported above background level concentrations for metals in the Omaha area (Table 2-5). Neither cadmium nor silver exceeded the RBCs. Petroleum hydrocarbons, as brake, hydraulic, and transmission fluid, were reported above the RBCs for all three scenarios by factors ranging from about 2 to 9.

Although petroleum hydrocarbons exceeded RBCs for all three scenarios, they did so by less than an order of magnitude in each case. It should be noted that the RBCs are very conservative estimates based on reasonable maximum exposures and a target risk of 1×10^{-6}. Actual exposures to soil contamination and resultant risks would be expected to be lower. Furthermore, exceeding the RBC by a factor of 9 would result in a risk estimate of 9×10^{-6} (even with the very conservative exposure assumptions), which is well within EPA's target risk range of 1×10^{-6} to 1×10^{-4} for risks due to releases from hazardous waste sites (EPA 1991d). Therefore, no significant human health risks would be expected in this area.

3.4 GAS HOUSE

The Gas House Area was located, from historical blueprints, near the southern boundary of the Omaha Shops. The blueprints indicated a gasoline off-loading area, pump house, and storage capabilities.

Four borings were completed in the Gas House Area (HDR 1990). One composite sample, consisting of soil collected from the surface and the bottom of each of the borings, was collected and analyzed for metals and VOCs. Junk fill, rocks, gravel, and sand mixed with silt and silty clay were encountered in all boreholes at 0 to 2 feet. Silty clay, dark gray to greenish-gray, very moist with a petroleum odor, was observed from 2 to 5 feet. Two boreholes were extended to 10 feet, and soils were observed to be saturated at 5-1/2 feet, turning gray to gray-brown with no odor. OVA readings ranged from 20 to 100 units in the borehole.

Table 3-5 compares the organics detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Antimony and cadmium were detected above background concentrations for metals in the Omaha area (Table 2-5). Metals which exceeded the background concentrations did not exceed any RBCs;

therefore, the metals are not considered to be of concern. Trichloroethene was the only VOC detected, and it was reported at a concentration which is below the RBCs.

Because there were no chemical concentrations at the Gas House Area which exceed RBCs, no human health risks would be expected in this area.

3.5 STORES AREA (EAST AND WEST)

The Stores Area is located near the southern boundary of the Omaha Shops. The Stores Area filled requisitions and furnished materials and supplies to all UPRR departments. A total of eight borings were completed in the Stores Area, four in the east section and four in the west section.

At the east Stores Area, one composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected (HDR 1990). The sample was analyzed for metals, pesticides/PCBs, and petroleum hydrocarbons. Borings were drilled to a depth of 5 feet at each location. OVA readings of 35 to 100 units were recorded in the boreholes. All four borings had a high petroleum product odor, and samples at depth were either wet or saturated.

At the west Stores Area, one composite sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for metals, pesticides/PCBs, and petroleum hydrocarbons (HDR 1990). Borings in the west Stores Area were also drilled to a depth of 5 feet at each location. Moist soils were encountered from 3-1/2 to 5 feet, with OVA readings ranging from 200 to 800 units above background in the borehole.

Table 3-6 and Table 3-7 compare the organics detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Cadmium and copper were reported at concentrations which exceeded the background concentrations for the east Stores Area (Table 2-5). Cadmium, copper, and zinc exceeded background concentrations for the west Stores Area (Table 2-5). Metals which exceeded background concentrations did not exceed any RBCs; therefore, the metals are not considered to be of concern at the site. None of the organics detected, TPH as No. 2 diesel fuel and pesticides/PCBs, exceeded any RBCs.

Because there were no chemical concentrations at the Stores Area (east and west) which exceeded RBCs, no human health risks would be expected in this area.

3.6 TRACTION MOTOR SHOP

The Traction Motor Shop is located near the southern boundary of the Omaha Shops. The primary objective of the Traction Motor Shop was to supply repaired electrical components for diesel-electric locomotives. This shop area was modernized in 1975, enabling UPRR to repair and rebuild traction motors previously sent to outside vendors. Various degreasing vats, above-ground tanks, and other ancillary support equipment were utilized in this process.

Four borings, to a depth of 7 feet each, were completed in the Traction Motor Shop Area. One composite sample, consisting of soils from the surface and the bottom of each of the four borings, was collected (HDR 1990). The sample was analyzed for priority pollutants. Discolored soils were observed in the borings completed in this area. A greenish-gray clay was observed from 1-1/2 to 4 feet with gravel intermixed with clay. OVA readings from 300 to greater than 1,000 units were recorded in each boring. Apparent petroleum-saturated soil was encountered in all four borings at depths between 5 to 7 feet.

Table 3-8 compares the organics detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Cadmium and copper were reported at concentrations which exceeded background level concentrations for metals in the Omaha area (Table 2-5). Metals which exceeded background concentrations did not exceed RBCs. Tetrachloroethene and 2-butanone were detected at the site at concentrations below the RBCs. TPH was detected at a concentration above the recreational RBC.

Although TPH exceeded the recreational RBC, it did so by less than an order of magnitude. It should be noted that RBCs are very conservative estimates based on reasonable maximum exposure and a target risk of 1×10^{-6}. Actual exposures to soil contamination and resultant risks would be expected to be lower. Furthermore, exceeding the conservative RBC by a factor of 3 would result in a risk estimate of 3×10^{-6}, even with the conservative exposure assumptions. This is well within EPA's target risk range of 1×10^{-6} to 1×10^{-4} for releases at hazardous waste sites (EPA 1991d). Therefore, no significant human health risks would be expected in this area.

3.7 BLUE BUILDING

The Blue Building is located near the southern boundary of the Omaha Shops. Activities in the Blue Building included disassembly, cleaning, and qualification for reuse, all mechanical locomotive parts. Various degreasing solvents and caustics were utilized in this production process.

Four borings, to a depth of 8 feet each, were completed in the Blue Building Area (HDR 1990). One composite sample, consisting of soils from the surface and bottom of each boring, was collected and analyzed for priority pollutants. Three borings were located on the east side of the Blue Building, and one boring was located on the north side of the Blue Building, outside the above-ground tank containment area. Moisture was observed in the 3- to 6-foot depth interval in the boring located north of the above-ground tank containment area. Free liquid (apparent petroleum-based product) was observed in three borings on the east side of the building from 6- to 8-foot depths.

The Storage Tank Area is located immediately north of and adjacent to the Blue Building. Concrete covered the area, with rubble fill, wood, bricks, concrete, silty sand, and gravel encountered from 1 to 5 feet deep. A very strong odor was observed at all locations with OVA readings greater than 1,000 units.

Eight soil vapor samples were obtained from the area. Previous soil sampling activities detected tetrachloroethene (PCE) in one soil sample in this area. Five of the eight soil vapor samples exhibited trace PCE concentrations ranging from 0.06 μg/L to 0.50 μg/L. An additional composite soil sample was collected and analyzed for VOCs.

Tables 3-9 and 3-10 compare the organics detected and the metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. At the Blue Building, cadmium and copper were detected above background level concentrations for the Omaha area (Table 2-5). Metals which exceeded the background level concentrations did not exceed any RBCs; all VOCs and pesticides/PCBs detected at the site were reported at concentrations below the RBCs.

Because there were no chemical concentrations at the Blue Building site which exceed RBCs, no human health risks would be expected in this area.

At the Storage Tank Area, PCE and trichloroethene (TCE) concentrations were reported above the RBCs. PCE exceeded the RBCs for all three exposure scenarios by factors ranging from about 10 to 700. TCE exceeded the occupational RBCs by a factor of about 6.

Since the PCE concentration exceeded the occupational RBC by more than 2 orders of magnitude, there may be a potential for health risks at this site. However, the RBCs are based on conservative estimates of exposures, and actual exposures at the site are expected to be less. In addition, this evaluation was based on a single composite sample which may overestimate actual exposure concentrations. Subsequent attempts to confirm the single high detection of PCE in this area failed to detect any PCE in the soil. In view of data, the data from the soil vapor study, and subsequent soil analyses, the high PCE concentration in the soil sample from this area appears to be suspect. It is unlikely, therefore, that human health risks would be expected in this area.

3.8 NEW TRANSFORMER STORAGE AREA

The New Transformer Storage Area is located on the southwestern boundary of the Omaha Shops. Three hand auger borings, to a depth of 1 foot each, were completed in the New Transformer Storage Area. One composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for PCBs (HDR 1990). All PCBs were reported as nondetect.

3.9 CHEMICAL STORAGE BUILDING

The Chemical Storage Building was located on the southern boundary of the Omaha Shops. Three borings were drilled to a depth of 5 to 10 feet. One composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for total metals, VOCs, and semivolatile organics (SVOCs) (HDR 1990). Concrete and asphalt were observed at 0 to 1 foot, and cinders, wood, brick, slag, sand, and gravel at 1 to 4 feet. One borehole was extended to 10 feet, and soils turned from black to greenish-gray

at 5 feet. The soils were very moist and a strong petroleum odor was present in all boreholes. OVA readings ranged from 20 to 60 units in the boreholes.

All target VOCs and SVOCs were reported as nondetect at this site. Table 3-11 compares the metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Antimony and cadmium were reported at concentrations which exceeded background level concentrations for metals in the Omaha area (Table 2-5). Metals which exceeded background level concentrations did not exceed RBCs.

Because there were no chemical concentrations at the Chemical Storage Building Area which exceed RBCs, no human health risks would be expected in this area.

3.10 OLD TRACTION MOTOR SHOP

The Old Traction Motor Shop was located near the southern boundary of the Omaha Shops. The Old Traction Motor Shop Area was identified through UPRR employee interviews. The facility is no longer in existence. Chemical compounds of primary interest were volatile organics, which were reportedly used as degreasing agents.

Three borings each, to a depth of 5 feet, were completed in the area of the Old Traction Motor Shop. OVA readings ranged from 40 units at the northeast boring to more than 600 units at the northwest boring. A VOC grab sample was collected. All target VOCs were reported as nondetect.

Because no chemicals were detected at the Old Traction Motor Shop Area, no human health risks would be expected in this area.

3.11 ACETYLENE PIT

The Acetylene Pit was located in the south-central area of the Omaha Shops. The Acetylene Pit produced acetylene gas by chemical reaction of calcium carbide (CaC_2) and water (H_20), yielding acetylene (C_2H_2) for welding operations, and calcium oxide. The building no longer exists; however, location of this area was determined by reference to blueprints and by UPRR employee interviews.

Three borings were completed in the Acetylene Pit Area. One composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for metals and petroleum hydrocarbons (HDR 1990). A strong petroleum odor was recorded at all boring locations, with OVA readings ranging from 200 to 1,000 units in the open borehole. Silty clay with brick, gravel, cinders, and sand was observed at 0 to 4 feet. Greenish-gray, soft, moist soils were encountered at 4 feet and extended to approximately 8 feet deep.

Table 3-12 compares the petroleum hydrocarbons detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Antimony, arsenic, cadmium, lead, and zinc were detected above background level concentrations for metals in the Omaha area (Table 2-5). Arsenic exceeded the RBC for the recreational and occupational scenarios by a factor of about 2 and 3, respectively. Petroleum hydrocarbons as No. 2 fuel oil were reported at concentrations below the RBCs.

Although arsenic exceeded recreational and occupational RBCs, it did so by less than an order of magnitude in each case. It should be noted that RBCs are very conservative estimates based on reasonable maximum exposure and a target risk of 1×10^{-6}. Actual exposures to soil contamination and resultant risks would be expected to be lower. Furthermore, exceeding the conservative RBC by a factor of 3 would result in a risk estimate of 3×10^{-6}, even with the conservative exposure assumptions. This is well within EPA's target risk range of 1×10^{-6} to 1×10^{-4} for releases at hazardous waste sites (EPA 1991d). Therefore, no significant human health risks would be expected in this area.

3.12 OIL TANKS/PUMP HOUSE

The Oil Tanks/Pump House Area is centrally located at the Omaha Shops. The Oil Tanks/Pump House Area was identified by a review of historical blueprints. This facility is no longer in operation, but foundation remnants and ancillary piping still remain.

Three borings were completed around the foundation of the old Pump House (HDR 1990). One composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for petroleum hydrocarbons and metals. A strong petroleum odor was observed in all three borings, and OVA readings greater than 100 units

were recorded in the open borehole. Approximately 1 foot of concrete was penetrated in the area before silty clay, dark gray to greenish-black, was encountered at 1 to 5 feet. One borehole was drilled to 10 feet and contamination appeared to continue to approximately 9 feet.

Table 3-13 compares the petroleum hydrocarbons detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Cadmium was the only metal which exceeded background concentrations for metals in the Omaha area (Table 2-5). Cadmium did not exceed RBCs, and petroleum hydrocarbons, as No. 1 fuel oil, were reported at concentrations that did not exceed RBCs.

Because there were no chemical concentrations at the Oil Tanks/Pump House Area which exceeded RBCs, no human health risks would be expected in this area.

3.13 BEARING SHOP

The Bearing Shop was centrally located at the Omaha Shops. The Bearing Shop was a production support area for the Wheel Shop. Processes conducted at the Bearing Shop included bearing removal and cleaning/degreasing wheel units for rebuilding.

Four borings were completed in this area (HDR 1990). A composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for petroleum hydrocarbons and metals. The Bearing Shop Area was covered with 0 to 1 foot of concrete followed by sand fill to 9 feet, then silty clay, greenish-gray to black in color, and moist. The OVA recorded greater than 1,000 units in the borehole. An apparent solvent odor was noted at three of the four borings. In view of this observation, a sample was also collected for VOC analysis.

Table 3-14 compares the organic chemicals detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Antimony and cadmium were reported at concentrations which exceeded background level concentrations for metals in the Omaha area (Table 2-5). These metals did not exceed any RBCs; and petroleum hydrocarbons, as gasoline, were reported at concentrations that did not exceed RBCs.

Because there were no chemical concentrations at the Bearing Shop Area which exceeded RBCs, no human health risks would be expected in this area.

3.14 WHEEL SHOP

The Wheel Shop is located in the east-central area of the Omaha Shops. The Wheel Shop produced locomotive and car wheels for the UPRR system. Production processes included dismounting, turning, remounting, and assembly with new or rebuilt traction motors. This production area was identified as utilizing a number of vats and underground tanks. A single boring was completed in the Wheel Shop Area. One composite soil sample, consisting of soils from the surface and the bottom of the boring, was collected and analyzed for metals, VOCs, and petroleum hydrocarbons (HDR 1990).

Table 3-15 compares the organic compounds detected to the RBCs for three exposure scenarios: recreational, occupational, and construction. No metals were detected above background concentrations for metals in the Omaha area (Table 2-5). All target VOCs were reported as nondetect. Petroleum hydrocarbons, as No. 2 diesel and as gasoline, were reported at concentrations which did not exceed any RBCs.

Because there were no chemical concentrations at the Wheel Shop Area which exceeded RBCs, no human health risks would be expected in this area.

3.15 POWER HOUSE

The Power House is located in the central part of the Omaha Shops. The Power House was constructed in 1963. Capacity of the Power House was 240,000 pounds of steam per hour from three combination liquid fuel-natural gas-powered boilers. Three air compressors were also operated in the plant to supply the shops with compressed air for operation of shop machinery. Another area, the Old Power House, was also investigated. The Old Power House was previously located south of the Power House and was demolished after the Power House was completed in 1963. Located to the north of the Power House, was an above-ground fuel tank and fuel offloading area. Some oil-stained surface soil was observed in the areas (HDR 1990).

Five borings to a depth of 5 feet each were completed in the Power House Area. Observations from the borings indicate the area to be a former fill area, as suggested by alternating layers of rubble, fill, and cinders. A composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for metals and petroleum hydrocarbons.

A composite soil sample, consisting of soils from the surface and the bottom of the five borings drilled in the Old Power House Area, was collected and analyzed for SVOCs, metals, and pesticides/PCBs. Soil discoloration was not observed in borings completed in the Old Power House Area. Building debris was observed in the boreholes, suggesting that the area was previously used as a fill area. Two of the five borings were abandoned and redrilled due to underlying obstacles. Brick fill, concrete, rubble, wood, and clay fill were encountered in the borings.

Table 3-16 compares the SVOCs and pesticides/PCBs detected at the site to the RBCs for three exposure scenarios: recreational, occupational, and construction. Metals, which were detected, were reported at concentrations which were below the background concentrations for metals in the Omaha area (Table 2-5). Benzo(a)pyrene exceeded the RBC for the recreational scenario by a factor of less than 2.

Although benzo(a)pyrene exceeded the recreational RBC, it did so by less than an order of magnitude. It should be noted that RBCs are very conservative estimates based on reasonable maximum exposures and a target risk of 1×10^{-6}. Actual exposures to soil contamination and resultant risks would be expected to be lower. Furthermore, exceeding the conservative RBC by a factor of 2 would result in a risk estimate of 2×10^{-6}, which is well within EPA's target risk range of 1×10^{-6} to 1×10^{-4} for releases at hazardous waste sites (EPA 1991d). Therefore, no significant human health risks would be expected in this area.

3.16 OIL AND WASTE HOUSE

The Oil and Waste House was centrally located at the Omaha Shops. The Oil and Waste House Area was identified from historical blueprints. Three borings were completed in the Oil and Waste House Area. A composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for metals and petroleum

hydrocarbons (HDR 1990). Junk fill, cinders, wire, sand, and gravel were observed in all three borings at 0 to 2 feet. Moist, reddish-brown clays with some silt were observed at 2 to 5 feet. No OVA readings or odors were recorded.

Table 3-17 compares metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. No petroleum hydrocarbons were detected at the site. Cadmium was the only metal reported at a concentration which exceeded the background concentrations. Cadmium did not exceed the RBC.

Because there were no chemical concentrations at the Oil and Waste House Area which exceeded RBCs, no human health risks would be expected at this site.

3.17 FUEL STORAGE AREA

The Fuel Storage Area is located along the southwestern boundary of the Omaha Shops. The Fuel Storage Area was comprised of two above-ground storage tanks (one gasoline, one diesel) and one fiberglass underground storage tank (gasoline). The above-ground tanks were surrounded by a 3-foot-high concrete spill containment wall. No soil samples were collected from this area.

3.18 TEMPORARY HAZARDOUS WASTE STORAGE AREA

The Temporary Hazardous Waste Storage Area is located along the southwestern boundary of the Omaha Shops. Three borings to a depth of 5 feet each were completed in the area (HDR 1990). A composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for priority pollutants and petroleum hydrocarbons. Soils were moist below 2 feet and very moist below 3 feet. No organic vapors were detected, with the exception of the north boring, where two units above background were observed in the borehole.

Table 3-18 compares the organics detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Copper was the only metal reported at a concentration which exceeded the background concentrations of metals in the Omaha area (Table 2-5). Copper, however, did not exceed RBCs. Aroclor

1232 exceeded the recreational and occupational RBCs by factors of about 1 and 2, respectively. Aldrin exceeded the recreational and occupational RBCs by factors of about 4 and 6, respectively. Aldrin co-eluted during analysis with delta-BHC. The concentrations reported for the compounds are the total for one or both of the co-eluted compounds; and if both compounds are present, the percentages of each are unknown.

Although aldrin and Aroclor 1232 exceeded recreational and occupational RBCs, they did so by less than an order of magnitude in each case. It should be noted that RBCs are very conservative estimates based on reasonable maximum exposures and a target risk of 1×10^{-6}. Actual exposures to soil contamination and resultant risks would be expected to be lower. Furthermore, exceeding the conservative RBC by a factor of 6 would result in a risk estimate of 6×10^{-6}, even with the conservative exposure assumptions. This is well within EPA's target risk range of 1×10^{-6} to 1×10^{-4} for releases at hazardous waste sites (EPA 1991d). Therefore, no significant human health risks would be expected at this site.

3.19 CAR DISMANTLE AREA (EAST AND WEST)

The Car Dismantle Area is located near the western boundary of the Omaha Shops. This area encompasses the Paint Barrel Pit, the Old Transformer Storage Area, and the Power House. The dismantling of steam locomotives, including their asbestos-containing boiler insulation, was reported to have been performed in the southern part of the east section of the Car Dismantle Area. The area is suspected to be contaminated with asbestos.

Ten borings were completed in the Car Dismantle Area, five in each of the two sections, east and west (HDR 1990). One composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected in both the east and west sections and analyzed for priority pollutants. Generally, the areas exhibited gravel and cinders to a depth of approximately 3 feet, followed by a saturated gravel with some sand between 4 and 5 feet. Samples exhibited heavy oxidation, and some metal shavings were also observed.

Tables 3-19 and 3-20 compare the organic compounds detected and the metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. No VOCs were detected in either the east or west section. For the east Car Dismantle Area, only copper was detected above background level concentrations for metals

in the Omaha area (Table 2-5). At the west Car Dismantle Area, cadmium, copper, mercury, and zinc exceeded the background levels for metals in the Omaha area (Table 2-5). The metals which exceeded the background level concentrations did not exceed any RBCs. None of the organics detected exceeded any of the RBCs.

Because there were no chemical concentrations at the Car Dismantle Area (east and west) which exceeded RBCs, no human health risks would be expected in this area.

3.20 OLD TRANSFORMER STORAGE AREA

The Old Transformer Storage Area was located near the western boundary of the Omaha Shops. Four hand auger borings were completed in the area (HDR 1990). Soil samples were taken from 3 inches to 12 inches. The four samples were combined into one composite sample and analyzed for PCBs. All PCBs were reported as nondetect at the site.

Because there were no chemicals detected at the Old Transformer Storage Area, no human health risks would be expected in this area.

3.21 PAINT BARREL PITS

The Paint Barrel Pits were located in the west-central portion of the Omaha Shops. In reviewing the UPRR archives of blueprints for the Omaha Shops, an area identified as the Paint Barrel Pits was located in the Car Dismantle Area directly south of the 12th and Izard Streets intersection. These two pits reportedly measured 150 feet long by 21 feet wide.

A total of six borings were completed in the area, spaced evenly through the apparent center of the old pits, as identified by historical blueprints (HDR 1990). A composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for metals and SVOCs. Junk fill, wood, asphalt, slag, wire, brass machine parts, asbestos, cinders, sand, gravel, and traces of clay were observed in the borings from 0 to 5 feet. Two borings were extended to 10 feet with dark gray silty clay encountered at 8 feet. A strong creosote odor was reported at the four boreholes closest to Izard Street, with OVA readings of 10 to 400 units.

Table 3-21 compares the organics detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Antimony, arsenic, cadmium, chromium, copper, lead, selenium, and thallium were reported at concentrations which exceeded the background concentrations for metals in the Omaha area (Table 2-5). Arsenic, lead, benzo(a)anthracene, and benzo(a)pyrene exceeded RBCs. The RBCs for all three exposure scenarios were exceeded for lead by a factor of about 8. Arsenic and benzo(a)pyrene exceeded the recreational and occupational RBCs by factors ranging from about 0 to 7. Benzo(a)anthracene exceeded the occupational RBC by a factor of about 1.

Although arsenic, lead, benzo(a)anthracene, and benzo(a)pyrene exceeded RBCs, they did so by less than an order of magnitude in each case. It should be noted that RBCs are very conservative estimates based on reasonable maximum exposures and a target risk of 1×10^{-6}. Actual exposures to soil contamination and resultant risks would be expected to be lower. Furthermore, exceeding the conservative RBC by a factor of 7 would result in a risk estimate of 7×10^{-6}, which is well within EPA's target risk range of 1×10^{-6} to 1×10^{-4} for releases at hazardous waste sites (EPA 1991d). Therefore, based on the comparison to RBCs, no significant human health risks would be expected at this site.

3.22 CAR SHOP

The Car Shop is located centrally at the Omaha Shops Yard. The Car Shop Area remains active and is equipped to perform plating, tinsmithing, upholstering, and carpentering operations required for special projects and business car remodeling. A variety of plating operations (e.g., chrome, brass, etc.) are performed which utilize cyanide as a complexing agent in the plating baths.

The Car Shop Area sampling consisted of a single boring near the cyanide tank (HDR 1990). A composite soil sample, consisting of soils from the surface and the bottom of the boring, was collected and analyzed for cyanide and metals. An MDA Monitox meter was used to monitor cyanide gas while drilling. The boring showed wet sands at 4 to 5 feet with Monitox readings remaining steady at 4 to 5 units. The sample collected was a wet sand with readings of 2 to 3 units (Monitox) at a depth of 6 feet.

Table 3-22 compares metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Cyanide was reported as nondetect for the site. Cadmium and silver exceeded background level concentrations for metals in the Omaha area (Table 2-5), but the concentrations of the metals did not exceed RBCs.

Because there were no chemical concentrations reported at the Car Shop Area which exceeded RBCs, no human health risks would be expected in this area.

3.23 STEEL SHOP

The Steel Shop is centrally located at the Omaha Shops. The Steel Shop Area was the final step in repair of damaged cars and cabooses. This area was also involved in painting of the finished cars. Review of building bluelines indicated a waste sump located within the building near this location. Potential utility conflicts were encountered when trying to locate borings on the north, south, and west sides of the building.

A single boring was completed in the Steel Shop Area (HDR 1990). A composite soil sample, consisting of soils from the surface and the bottom of the boring, was collected and analyzed for priority pollutants. The boring from the surface to 2 feet was gravelly fill. The strata from 2 feet to 4-1/2 feet consisted of a gray clay stained to a blue color. OVA readings of 200+ units were recorded in the borehole. A sand seam encountered from 4-1/2 to 5 feet was apparently saturated with petroleum product.

Table 3-23 compares the organic compounds detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Cadmium and copper were reported at concentrations which exceeded background concentrations for metals in the Omaha area (Table 2-5). The metals did not exceed any RBCs. Aldrin, dieldrin, Aroclor 1221, and Aroclor 1016 exceeded the RBCs. Aldrin, dieldrin, and Aroclor 1221 exceeded the recreational and occupational RBCs by factors ranging from about 1 to 5. Aroclor 1016 very slightly exceeded the occupational RBC. During analysis, aldrin co-eluted with delta-BHC. The concentrations reported for these compounds are the total for one or both of the co-eluted compounds; and if both compounds are present, the percentages of each are unknown.

Although aldrin, dieldrin, Aroclor 1221, and Aroclor 1016 exceeded RBCs, they did so by less than an order of magnitude in each case. It should be noted that the RBCs used are very conservative estimates based on reasonable maximum exposures and a target risk of 1×10^{-6}. Actual exposures to soil contamination and resultant risks would be expected to be lower. Furthermore, exceeding the conservative RBC by a factor of 5 would result in a risk estimate of 5×10^{-6}, which is well within EPA's target risk range of 1×10^{-6} to 1×10^{-4} for releases at hazardous waste sites (EPA 1991d). Therefore, no significant human health risks would be expected in this area.

3.24 CAR HOLDING AREA

The Car Holding Area is located in the north-central area of the Omaha Shops (just north of the Steel Shop). The primary purpose of this area was to initiate the repair process of damaged cars prior to completion inside the Steel Shop.

Three borings to a depth of 5 feet each were completed in the Car Holding Area (HDR 1990). A composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for priority pollutants. Discolored soil was not observed in samples collected in this area. No OVA readings were recorded above background.

Table 3-24 compares the organic compounds detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. All target VOCs were reported as nondetect for the site. Cadmium, copper, and zinc were detected above background concentrations for metals in the Omaha area. The metals which exceeded the background concentrations did not exceed any RBCs. All organics were reported below RBCs.

Because there were no chemical concentrations at the Car Holding Area which exceeded RBCs, no human health risks would be expected in this area.

3.25 CAR DEMOLISH AREA

The Car Demolish Area is located in the northern part of the Omaha Shops. The Car Demolish Area is comprised of three cinder pits where damaged railcars were cut up for scrap.

A 20-foot-deep monitoring well (MW-6) was constructed in the Car Demolish Area on the east side of the north demolition pit (HDR 1990). A composite soil sample, consisting of soils from the surface and the bottom of the well, was collected and analyzed for priority pollutants. No apparent soil discoloration was recorded, and organic vapors recorded were negligible.

Table 3-25 compares the organic compounds detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. All target VOCs were reported as nondetect for the site. Chromium, mercury, and selenium were detected above background concentrations for metals in the Omaha area (Table 2-5). The metals which exceeded the background concentrations did not exceed any RBCs. Aldrin was reported at concentrations which very slightly exceeded the occupational RBC. Aldrin co-eluted with delta-BHC during analysis. The concentrations reported for the compounds are the total for one or both of the compounds; and if both compounds are present, the percentages of each are unknown.

Since aldrin exceeded the occupational RBC by only a very slight margin, and since the actual concentration is likely to be lower than the reported concentration because of co-elution, no significant human health risks would be expected at this site.

3.26 OPEN DRUM STORAGE AREA (NORTH AND SOUTH)

The Open Drum Storage Area is located in the northern area of the Omaha Shops. The south area was an active drum storage area. The north area was used for semitrailer parking and miscellaneous equipment storage.

A total of ten 5-foot borings were completed in the Open Drum Storage Area, consisting of five in the south area and five in the north area (HDR 1990). A composite soil sample,

consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for metals, pesticides/PCBs, and VOCs. In the north Open Drum Storage Area, the borings revealed increased sand content and more rubble fill. In the northeast boring, organic vapor readings in the split-spoon sample exceeded 30 units above background. Discolored sand with an apparent diesel fuel odor was observed in the sample. In the south area, observed organic vapor readings at the time of sampling ranged from 3 to 6 OVA units above background in the breathing zone, and readings of greater than 30 units were recorded in the center borehole.

Table 3-26 compares the organic compounds detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction at the south Open Drum Storage Area. All target SVOCs and VOCs were reported as nondetect. Silver and selenium were reported at concentrations which exceeded background concentrations for metals in the Omaha area (Table 2-5); however, they did not exceed any RBCs. Chlordane is the only pesticide/PCB detected, and it was detected at a concentration below all RBCs.

Because there are no chemical concentrations at the south Open Drum Storage Area which exceeded RBCs, no human health risks would be expected at the south site.

Table 3-27 compares the organic compounds detected and metals detected above background concentrations at the site and compares the concentrations reported to the RBCs for three exposure scenarios: recreational, occupational, and construction at the north Open Drum Storage Area. All target VOCs and SVOCs were reported as nondetect for the site. Arsenic, chromium, copper, lead, mercury, silver, selenium, and zinc were reported at concentrations which exceeded background concentrations for metals in the Omaha area (Table 2-5). Lead, arsenic, and aldrin exceeded the RBCs. Lead exceeded the RBCs for all three exposure scenarios by a factor of about 2. Arsenic and aldrin exceeded the recreational and occupational RBCs by factors ranging from about 2 to 6. Aldrin and delta-BHC co-eluted during analysis. The concentrations reported for the compounds are the total for one or both of the co-eluted compounds; therefore, if both compounds are present, the percentages of each are unknown.

Although aldrin, arsenic, and lead exceeded the RBCs, they did so by less than an order of magnitude in each case. It should be noted that RBCs are very conservative estimates based on reasonable maximum exposures and a target risk of 1×10^{-6}. Actual exposures to soil contamination and resultant risks would be expected to be lower. Furthermore, exceeding the conservative RBC by a factor of 6 would result in a risk estimate of 6×10^{-6}, which is well within EPA's target risk range of 1×10^{-6} to 1×10^{-4} for releases at hazardous waste sites (EPA 1991d). Therefore, no significant human health risks would be expected in this area.

3.27 EIGHTH STREET YARD (SOUTH, CENTRAL, AND NORTH SECTIONS)

The Eighth Street Yard is located along the eastern boundary of the Omaha Shops. The Eighth Street Yard was a car holding area and switching yard. The Eighth Street Yard was divided into three sections designated south, central, and north. Each section represents approximately one-third of the Eighth Street Yard Area.

Four borings were completed in the south section, four in the central, and five in the north (HDR 1990). A composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for metals, pesticides/PCBs, and SVOCs. Borehole materials encountered included rubble fill and compacted clay in the south and central sections, with increasing sand content in the north section. Visible soil staining was not observed. One discrete sample was collected from each section and analyzed for VOCs. All target VOCs were reported as nondetect at the site. Table 3-28 through Table 3-30 compare the organic compounds detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction.

For the central section, copper, silver, and zinc exceeded background level concentrations for metals in the Omaha area (Table 2-5). The metals which exceeded background concentrations did not exceed any RBCs. Aldrin was reported at concentrations which exceeded the recreational and occupational RBCs by factors of about 2 and 3, respectively. However, aldrin co-eluted with delta-BHC, and the concentration reported for the compounds is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

Since aldrin only exceeded the recreational and occupational RBCs by factors of 2 and 3, and since the actual concentration may be lower than the reported concentration because of co-elution, no significant human health risks would be expected at the central section of the site.

For the north section, arsenic, cadmium, copper, lead, mercury, silver, selenium, and zinc exceeded background level concentrations for metals in the Omaha area (Table 2-5). Aldrin, dieldrin, and heptachlor epoxide exceeded recreational and occupational RBCs. Arsenic exceeded the recreational and occupational RBCs by factors of about 12 and 19, respectively. The pesticides exceeded RBCs by factors ranging from about 1 to 5. Heptachlor epoxide and aldrin co-eluted with beta-BHC and delta-BHC, respectively. The concentrations reported for the compounds are the total for one or both of the compounds; and if both compounds are present, the percentages of each are unknown. Arsenic may be considered a chemical of concern at this site because the concentration exceeded RBCs by a factor greater than 10.

Since aldrin, dieldrin, and heptachlor only slightly exceeded the recreational and occupational RBCs, and since actual concentrations may be lower than the reported concentrations because of co-elution, these pesticides are not expected to pose a significant health risk at this site. The estimated lifetime excess cancer risk associated with this arsenic concentration, which exceeds the RBC by a factor of 19, would be 1.9×10^{-5}. This is within the EPA's target risk range of 1×10^{-6} to 1×10^{-4} (1 in 1,000,000 to 1 in 10,000) for exposure to chemicals released from hazardous waste sites (EPA 1991d). Therefore, based on the comparison to RBCs, no significant human health risks would be expected at this site. However, further evaluation of this site in a site-specific risk assessment may be warranted.

For the south section, arsenic, cadmium, copper, lead, mercury, silver, selenium, and zinc exceeded background level concentrations for metals in the Omaha area (Table 2-5). Arsenic exceeded the recreational and occupational RBCs by factors of about 24 and 37, respectively.

Arsenic exceeded recreational and occupational RBCs by more than an order of magnitude. The estimated lifetime excess cancer risk associated with this arsenic concentration, which exceeds RBCs by a factor of 37, would be 3.7×10^{-5}. This is within the EPA's target risk range of 1×10^{-6} to 1×10^{-4} (1 in 1,000,000 to 1 in 10,000) for exposure to chemicals released from hazardous waste sites (EPA 1990; EPA 1991). Therefore, based on the

comparison to RBCs, no significant human health risks would be expected at this site. However, further evaluation of this site in a site-specific risk assessment may be warranted.

3.28 GRACE STREET YARD

The Grace Street Yard is located near the northern boundary of the Omaha Shops. The Grace Street Yard was used as a car holding and fueling area.

Four borings were drilled to a depth of 5 feet at the Grace Street Yard (HDR 1990). A composite soil sample, consisting of soils from the surface and the bottom of each of the borings, was collected and analyzed for metals, VOCs, SVOCs, and pesticides/PCBs. In two of the four borings, a light gray, soft, "foamy" material was encountered from 1 to 2-1/2 feet. No organic vapor analyzer readings above background were recorded. Rubble fill, railroad ballast, wood fragments, and cinders were observed in all of the borings. Moist gray and olive green clays with some silt and sand were present at depths of 3-1/2 to 5 feet. Depth to water in the borings was approximately 4 feet.

Table 3-31 compares the organic compounds detected and metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. All target VOCs were reported as nondetect for the site. Copper and selenium were reported at concentrations which exceeded the background concentrations for metals in the Omaha area (Table 2-5). All of the pesticides/PCBs, SVOCs, and metals were at concentrations which did not exceed RBCs.

Because there were no chemical concentrations at the Grace Street Yard Area which exceeded RBCs, no human health risks would be expected in this area.

3.29 GRACE STREET TANK

The Grace Street Tank was located near the northern boundary of the Omaha Shops. The Grace Street Tank was an above-ground, 55,000-gallon tank used for diesel fuel storage. The tank provided fuel storage for the Grace Street Yard, Locomotive Shop, and Union Station on South 10th Street.

Four hand auger borings were made, one on each of the north, east, south, and west sides of the tank (HDR 1990). Samples were collected from depths of 12 to 32 inches. Each boring exhibited highly stained soils and an accompanying petroleum odor. The west and north borings indicated free product in the sand layer encountered from 12 to 18 inches. The four boring samples were composited and analyzed for total recoverable petroleum hydrocarbons.

Table 3-32 compares the petroleum hydrocarbons, as diesel, detected to the RBCs for three exposure scenarios: recreational, occupational, and construction. Petroleum hydrocarbons as diesel fuel were reported at a concentration below all the RBCs.

Because there were no chemical concentrations at the Grace Street Tank Area which exceeded RBCs, no human health risks would be expected at this site.

3.30 OIL PIPELINE

The Oil Pipeline originated at the Grace Street Tank. The 4-inch-diameter pipe ran the entire length of the Omaha Shops and terminated at 10th Street. A total of nine borings were completed along the Oil Pipeline from the Grace Street Tank to the Wastewater Treatment Area. A grab sample was collected at each borehole and analyzed for petroleum hydrocarbons. Petroleum odors were observed in five of the nine boreholes.

Table 3-33 compares the maximum concentration of petroleum hydrocarbons (as No. 2 fuel oil) to the RBCs for three exposure scenarios: recreational, occupational, and construction. Fuel Oil No. 2 was detected in six of the nine samples ranging from 27 mg/kg to 4,400 mg/kg. The fuel oil maximum concentration was not detected above any of the RBCs.

Because there were no chemical concentrations at the Oil Pipeline Area which exceeded RBCs, no human health risks would be expected in this area.

3.31 CONSTRUCTION AREA

The Construction Area, investigated by W-C in 1992 (W-C 1992), occupies about 100 acres in the central part of the Omaha Shops. The Construction Area includes a portion of the Omaha Shops property that may be disturbed by future construction. Possible construction

could include future buildings and relocation of a large sewer. Major existing buildings located within the limits of the Construction Area include the Fabrication Shop, Print Shop, Wheel Shop, Car Shop, Steel Shop, and Wood Mill Building. The area also includes portions of the Traction Motor Shop and Power House. Portions of the Construction Area were identified and evaluated as operational areas in the Phase I Site Assessment (HDR 1990).

At the Construction Area, nineteen borings were drilled. Three to four samples were collected from each boring and analyzed for metals, VOCs, SVOCs, and pesticides/PCBs. Table 3-34 compares the maximum concentration of the organics detected and the metals detected above background to the RBCs for three exposure scenarios: recreational, occupational, and construction. Arsenic, barium, beryllium, cadmium, chromium, copper, lead, silver, and selenium were reported at concentrations which exceeded background level concentrations for metals in the Omaha area (Table 2-5). Arsenic, chromium, and lead exceeded both the background concentrations and the RBCs. The RBCs for all three exposure scenarios were exceeded by lead by a factor of about 2. Arsenic exceeded the recreational and occupational RBCs by factors of about 2 and 3, respectively. All of the organics reported at this site were below RBCs. Chromium exceeded the recreational RBC by a factor of about 4.

Although arsenic, chromium, and lead exceeded RBCs, they did so by less than an order of magnitude in each case. It should be noted that RBCs are very conservative estimates based on reasonable maximum exposures and a target risk of 1×10^{-6}. Actual exposures to soil contamination and resultant risks would be expected to be lower. Furthermore, exceeding the conservative RBC by a factor of 2 would result in a risk estimate of 2×10^{-6}, which is well within EPA's target risk range of 1×10^{-6} to 1×10^{-4} for releases at hazardous waste sites (EPA 1991d). Therefore, no significant human health risks would be expected in this area.

TABLE 3-1

COMPARISON OF SITE CONCENTRATIONS AT THE OIL STORAGE AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Antimony	2.10E+01	1.24E+03	2.82E+03	4.73E+03
Arsenic	**6.80E+01**	**1.77E+01**	**1.13E+01**	4.73E+02
Cadmium	4.40E+00	3.10E+03	7.05E+03	1.18E+04
Copper	1.60E+02	1.15E+05	2.61E+05	4.38E+05
Lead(5)	8.30E+02	1.00E+03	1.00E+03	1.00E+03
Zinc	9.60E+02	9.31E+05	2.11E+06	3.55E+06
TPH (as #2 Fuel Oil)	6.90E+03	2.48E+04	5.64E+04	9.46E+04

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) A composite sample was collected from three borings at the Oil Storage Area.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) EPA recommends an acceptable range of 500-1000 mg/kg lead in residential soil (EPA 1989) .

TABLE 3-2

COMPARISON OF SITE CONCENTRATIONS AT THE ROUNDHOUSE TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Cadmium	2.00E-01	3.10E+03	7.05E+03	1.18E+04
Pesticides/PCBs				
alpha-BHC	1.39E+00	NTF	NTF	NTF
beta-BHC(5)	1.17E+00	1.72E+01	1.10E+01	4.60E+02
delta-BHC(6)	1.51E+00	NTF	NTF	NTF
Heptachlor(5)	1.17E+00	6.89E+00	4.38E+00	1.84E+02
Aldrin(6)	**1.51E+00**	1.82E+00	**1.16E+00**	4.87E+01
Aroclor-1221	1.21E+00	4.03E+00	2.56E+00	1.08E+02
Aroclor-1248	1.81E-01	4.03E+00	2.56E+00	1.08E+02

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA-established toxicity factor

(1) A composite sample was collected from three borings at the Roundhouse.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

(6) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-3

COMPARISON OF SITE CONCENTRATIONS AT THE BABBITT SHOP AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Antimony	1.70E+01	1.24E+03	2.82E+03	4.73E+03
Cadmium	3.90E+00	3.10E+03	7.05E+03	1.18E+04
Copper	1.30E+02	1.15E+05	2.61E+05	4.38E+05
Lead(5)	8.10E+02	1.00E+03	1.00E+03	1.00E+03
Mercury	7.30E-01	9.31E+05	2.11E+06	3.55E+06
Volatiles				
Benzene	6.00E-01	1.32E+02	2.02E+01	1.54E+03
Ethylbenzene	6.70E+00	6.57E+04	3.89E+04	1.16E+05
Xylene (total)	4.20E+00	6.20E+06	1.41E+07	2.37E+07
Trichloroethene	7.00E-01	1.17E+02	1.67E+01	1.29E+03
TPH (as #2 Fuel Oil)	2.40E+03	2.48E+04	5.64E+04	9.46E+04

All concentrations are in mg/kg.
Shaded areas denote RBCs which were exceeded by the site concentration.
(1) A composite sample was collected from four borings at the Babbitt Shop.
(2) RBC: Risk-based concentrations based on recreational exposures.
(3) RBC: Risk-based concentrations based on occupational exposures.
(4) RBC: Risk-based concentrations based on construction exposures.
(5) EPA recommends an acceptable range of 500-1000 mg/kg lead in residential soil (EPA 1989) .

TABLE 3-4

COMPARISON OF SITE CONCENTRATIONS AT THE WASTEWATER TREATMENT AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Cadmium	3.00E-01	3.10E+03	7.05E+03	1.18E+04
Silver	2.00E+00	1.55E+04	3.52E+04	5.91E+04
Petroleum Hydrocarbons				
TPH (as Gasoline)	2.16E+01	1.82E+04	1.16E+04	4.87E+05
TPH (as brake, hydraulic, & transmission fluid)	2.14E+05	2.48E+04	5.64E+04	9.46E+04
TPH (as various petroleum)	1.11E+04	2.48E+04	5.64E+04	9.46E+04
TPH (as #2 Fuel Oil)	5.57E+03	2.48E+04	5.64E+04	9.46E+04

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) Site concentration represents the maximum concentration detected in five samples and a composite sample at the Wastewater Treatment Area.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-5

COMPARISON OF SITE CONCENTRATIONS AT THE GAS HOUSE TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Antimony	1.10E+01	1.24E+03	2.82E+03	4.73E+03
Cadmium	7.50E-01	3.10E+03	7.05E+03	1.18E+04
Volatiles				
Trichloroethene	5.00E-01	1.17E+02	1.67E+01	1.29E+03

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) A composite sample was collected from four borings at the Gas House.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-6

COMPARISON OF SITE CONCENTRATIONS AT THE EAST SECTION OF THE STORES AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Cadmium	2.00E-01	3.10E+03	7.05E+03	1.18E+04
Copper	3.49E+02	1.15E+05	2.61E+05	4.38E+05
Pesticides/PCBs				
delta-BHC(5)	1.31E-01	NTF	NTF	NTF
gamma-BHC	8.23E-03	2.39E+01	1.52E+01	6.37E+02
Aldrin(5)	1.31E-01	1.82E+00	1.16E+00	4.87E+01
4,4'DDT	3.31E-02	9.12E+01	5.80E+01	2.44E+03

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from four borings at the East Section of the Stores Area.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-7

COMPARISON OF SITE CONCENTRATIONS AT THE WEST SECTION OF THE STORES AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Cadmium	1.00E-01	3.10E+03	7.05E+03	1.18E+04
Copper	2.18E+02	1.15E+05	2.61E+05	4.38E+05
Zinc	2.32E+03	9.31E+05	2.11E+06	3.55E+06
TPH (as #2 Diesel)	2.13E+01	2.48E+04	5.63E+04	9.46E+04

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from four borings at the West Section of the Stores Area.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-8

COMPARISON OF SITE CONCENTRATIONS AT THE TRACTION MOTOR SHOP TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Cadmium	3.00E-01	3.10E+03	7.05E+03	1.18E+04
Copper	1.82E+02	1.15E+05	2.61E+05	4.38E+05
Volatiles				
2-Butanone	3.67E+00	4.55E+04	2.92E+04	8.51E+04
Tetrachloroethene	4.88E-01	4.01E+02	5.84E+01	4.51E+03
TPH (as #2 Diesel)	2.80E+04	2.48E+04	5.64E+04	9.46E+04

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from four borings at theTraction Motor Shop.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-9

COMPARISON OF SITE CONCENTRATIONS AT THE BLUE BUILDING TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Cadmium	4.00E-01	3.10E+03	7.05E+03	1.18E+04
Copper	2.62E+02	1.15E+05	2.61E+05	4.38E+05
Volatiles				
Toluene	4.19E-01	1.49E+04	7.50E+03	2.33E+04
Xylene (total)	2.32E+00	6.20E+06	1.41E+07	2.37E+07
Pesticides/PCBs				
beta-BHC(5)	1.26E-01	1.72E+01	1.10E+01	4.60E+02
delta-BHC(6)	2.28E-01	NTF	NTF	NTF
gamma-BHC	1.43E-01	2.39E+01	1.52E+01	6.37E+02
Heptachlor(5)	1.27E-01	6.89E+00	4.38E+00	1.84E+02
Aldrin(6)	2.28E-01	1.82E+00	1.16E+00	4.87E+01
4,4'DDE	1.17E-01	9.12E+01	5.80E+01	2.44E+03
4,4'-DDD	4.50E-01	1.29E+02	8.22E+01	3.45E+03
Chlordane	1.80E-01	2.39E+01	1.52E+01	6.37E+02

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from seven borings at the Blue Building.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

(6) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-10

COMPARISON OF SITE CONCENTRATIONS AT THE SOIL STORAGE TANK AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Volatiles				
Toluene	1.40E+00	1.49E+04	7.50E+03	2.33E+04
Xylene (total)	2.40E+00	6.20E+06	1.41E+07	2.37E+07
Tetrachloroethene	**4.10E+04**	**4.01E+02**	**5.84E+01**	**4.51E+03**
Trichloroethene	**9.70E+01**	1.17E+02	**1.67E+01**	1.29E+03

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) A composite sample was collected from the Soil Storage Tank Area.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-11

COMPARISON OF SITE CONCENTRATIONS AT THE CHEMICAL STORAGE BUILDING TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Antimony	1.10E+01	1.24E+03	2.82E+03	4.73E+03
Cadmium	8.20E-01	3.10E+03	7.05E+03	1.18E+04

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) A composite sample was collected from three borings at the Chemical Storage Building.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-12

COMPARISON OF SITE CONCENTRATIONS AT THE ACETYLENE PITS TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Antimony	2.80E+01	1.24E+03	2.82E+03	4.73E+03
Arsenic	**3.50E+01**	**1.77E+01**	**1.13E+01**	4.73E+02
Cadmium	2.50E+00	3.10E+03	7.05E+03	1.18E+04
Lead(5)	6.90E+02	1.00E+03	1.00E+03	1.00E+03
Zinc	7.30E+02	9.31E+05	2.11E+06	3.55E+06
TPH (as #2 Fuel Oil)	2.40E+02	2.48E+04	5.64E+04	9.46E+04

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) A composite sample was collected from three borings at the Acetylene Pits.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) EPA recommends an acceptable range of 500-1000 mg/kg lead in residential soil (EPA 1989) .

TABLE 3-13

COMPARISON OF SITE CONCENTRATIONS AT THE OIL TANKS/PUMP HOUSE AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Cadmium	4.80E-01	3.10E+03	7.05E+03	1.18E+04
TPH (as #1 Fuel Oil)	6.90E+03	2.48E+04	5.64E+04	9.46E+04

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) A composite sample was collected from three borings at the Oil Tanks/Pump House Area.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-14

COMPARISON OF SITE CONCENTRATIONS AT THE BEARING SHOP TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Antimony	1.10E+01	1.24E+03	2.82E+03	4.73E+03
Cadmium	5.00E-01	3.10E+03	7.05E+03	1.18E+04
TPH (as Gasoline)	5.80E+02	1.82E+04	1.16E+04	4.87E+05

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) A composite sample was collected from four borings at the Bearing Shop.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-15

COMPARISON OF SITE CONCENTRATIONS AT THE WHEEL SHOP TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
TPH (as #2 Diesel)	8.30E+00	2.48E+04	5.64E+04	9.46E+04
TPH (as Gasoline)	1.18E+01	1.82E+04	1.16E+04	4.87E+05

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) A composite sample was collected from one boring at the Wheel Shop.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-16

COMPARISON OF SITE CONCENTRATIONS AT THE POWER HOUSE TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Pesticides/PCBs				
alpha-BHC	8.00E-02	NTF	NTF	NTF
beta-BHC(5)	9.30E-02	1.72E+01	1.10E+01	4.60E+02
delta-BHC(6)	2.09E-01	NTF	NTF	NTF
Heptachlor(5)	9.30E-02	6.89E+00	4.38E+00	1.84E+02
Aldrin(6)	2.09E-01	1.82E+00	1.16E+00	4.87E+01
4,4'DDT	4.50E-02	9.12E+01	5.80E+01	2.44E+03
4,4'DDE	3.40E-02	9.12E+01	5.80E+01	2.44E+03
Semivolatiles				
Phenol	2.66E-01	1.86E+06	4.23E+06	7.10E+06
2-Methylphenol	7.79E-02	1.55E+05	3.52E+05	5.91E+05
4-Methylphenol	5.02E-01	1.55E+04	3.52E+04	5.91E+04
2,4-Dichlorophenol	1.14E-01	9.31E+03	2.11E+04	3.55E+04
Anthracene	4.73E+00	9.31E+05	2.11E+06	3.55E+06
Pyrene	1.25E+01	9.31E+04	2.11E+05	3.55E+05
Naphthalene	3.64E+00	1.24E+04	2.82E+05	4.73E+05
Acenaphthylene	2.13E-01	NTF	NTF	NTF
Acenaphthene	2.27E+00	1.86E+05	4.23E+05	7.10E+05
Dibenzofuran	2.30E+00	NTF	NTF	NTF
Diethylphthalate	2.12E-01	2.48E+06	5.64E+06	9.46E+06
Fluorene	2.86E+00	1.24E+05	2.82E+05	4.73E+05
Phenanthrene	1.22E+01	NTF	NTF	NTF
Benzo(a)anthracene	8.34E+00	3.12E+01	2.16E+01	8.44E+02
Chrysene	8.63E+00	1.03E+03	7.15E+01	2.79E+04
Benzo(b)fluoranthene	4.85E+00	3.24E+01	2.24E+01	8.77E+02
Benzo(k)fluoranthene	4.49E+00	8.27E+01	5.72E+01	2.24E+03
Benzo(a)pyrene	**6.17E+00**	**4.53E+00**	**3.14E+01**	1.22E+02
Indeno(1,2,3-cd)pyrene	3.67E+00	1.96E+01	1.35E+01	5.29E+02
Dibenzo(a,h)anthracene	1.01E+00	4.08E+00	2.83E+01	1.10E+02
Benzo(g,h,i)Perylene	4.36E+00	NTF	NTF	NTF
2-Methylnaphthalene	2.70E+00	NTF	NTF	NTF

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) A composite sample was collected from five borings at the Power House.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

(6) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-17

COMPARISON OF SITE CONCENTRATIONS AT THE OIL AND WASTE HOUSE TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Cadmium	4.20E-01	3.10E+02	7.05E+03	1.18E+04

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) A composite sample was collected from three borings at the Oil and Waste House.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-18

COMPARISON OF SITE CONCENTRATIONS AT THE TEMPORARY HAZARDOUS WASTE STORAGE AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Copper	3.65E+02	1.15E+05	2.61E+05	4.38E+05
Volatiles				
Methylene chloride	4.09E-02	5.42E+01	7.58E+00	5.91E+01
Acetone	8.29E-02	3.10E+05	7.05E+05	1.18E+06
Pesticides/PCBs				
alpha-BHC	1.68E-01	NTF	NTF	NTF
beta-BHC(5)	2.63E+00	1.72E+01	1.10E+01	4.60E+02
delta-BHC(6)	7.30E+00	NTF	NTF	NTF
gamma-BHC	1.20E+00	2.39E+00	5.42E+00	9.10E+00
Heptachlor(5)	2.63E+00	6.89E+00	4.38E+00	1.84E+02
Aldrin(6)	**7.30E+00**	**1.82E+00**	**1.16E+00**	4.87E+01
Heptaclor epoxide	6.20E-01	3.41E+00	2.17E+00	9.10E+01
4,4'DDE	7.43E-01	9.12E+01	5.80E+01	2.44E+03
4,4'-DDD	1.70E-02	1.29E+02	8.22E+01	3.45E+03
Endosulfan I	7.91E-01	NTF	NTF	NTF
Chlordane	9.76E-01	2.39E+01	1.52E+01	6.37E+02
Aroclor 1232	**4.88E+00**	**4.03E+00**	**2.56E+00**	1.08E+02
Petroleum Hydrocarbons				
TPH (as #2 Diesel)	1.59E+01	2.48E+04	5.64E+04	9.46E+04
TPH (as Gasoline)	4.63E+01	1.82E+04	1.16E+04	4.87E+05

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from three borings at the Temporary Hazardous Waste Storage Area.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

(6) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-19

COMPARISON OF SITE CONCENTRATIONS AT THE EAST CAR DISMANTLE AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Copper	1.85E+02	1.15E+05	2.61E+05	4.38E+05
Pesticides/PCBs				
alpha-BHC	2.56E-01	NTF	NTF	NTF
beta-BHC(6)	1.20E-02	1.72E+01	1.10E+01	4.60E+02
delta-BHC(5)	3.30E-02	NTF	NTF	NTF
Heptachlor(6)	1.20E-02	6.89E+00	4.38E+00	1.84E+02
Aldrin(5)	3.30E-02	1.82E+00	1.16E+00	4.87E+01
Dieldrin	2.30E-02	1.94E+00	1.23E+00	5.17E+01
4,4'DDE	3.90E-02	9.12E+01	5.80E+01	2.44E+03
4,4'-DDD	3.40E-02	1.29E+02	8.22E+01	3.45E+03
Endosulfan I	1.80E-02	NTF	NTF	NTF
Semivolatiles				
Anthracene	9.50E-02	9.31E+05	2.11E+06	3.55E+06
Pyrene	6.30E-01	9.31E+04	2.11E+05	3.55E+05
Phenanthrene	8.30E-01	NTF	NTF	NTF
Chrysene	6.38E-01	1.03E+03	7.15E+02	2.79E+04
Benzo(b)fluoranthene	3.43E-01	3.24E+01	2.24E+01	8.77E+02
Benzo(k)fluoranthene	3.65E-01	8.27E+01	5.72E+01	2.24E+03
Benzo(a)pyrene	3.43E-01	4.53E+00	3.14E+00	1.22E+02
Indeno(1,2,3-cd)pyrene	6.96E-01	1.96E+01	1.35E+01	5.29E+02
Benzo(g,h,i)Perylene	1.04E+00	NTF	NTF	NTF
Di-n-butylphthalate	1.02E-01	3.10E+05	7.05E+05	1.18E+06

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from five borings at the East Car Dismantle Area.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

(6) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-20

COMPARISON OF SITE CONCENTRATIONS AT THE WEST CAR DISMANTLE AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Cadmium	6.00E-01	3.10E+03	7.05E+03	1.18E+04
Copper	2.25E+02	1.15E+05	2.61E+05	4.38E+05
Mercury	2.60E+00	9.31E+02	2.11E+03	3.55E+03
Zinc	6.13E+02	9.31E+05	2.11E+06	3.55E+06
Pesticides/PCBs				
beta-BHC(5)	5.20E-02	1.72E+01	1.10E+01	4.60E+02
delta-BHC(6)	1.22E-01	NTF	NTF	NTF
gamma-BHC	2.00E-02	2.39E+01	1.52E+01	6.37E+02
Heptachlor(5)	5.20E-02	6.89E+00	4.38E+00	1.84E+02
Aldrin(6)	1.22E-01	1.82E+00	1.16E+00	4.87E+01
Dieldrin	4.64E-01	1.94E+00	1.24E+00	5.17E+01
4,4'DDT	2.80E-02	9.12E+01	5.80E+01	2.44E+03
4,4'DDE	3.89E-01	9.12E+01	5.80E+01	2.44E+03
Endosulfan I	3.01E-01	NTF	NTF	NTF
Chlordane	2.72E-01	2.39E+01	1.52E+01	6.37E+02
Aroclor 1254	2.05E+00	4.03E+00	2.56E+00	1.08E+02
Semivolatiles				
Anthracene	6.11E-01	9.31E+05	2.11E+06	3.55E+06
Pyrene	5.09E-01	9.31E+04	2.11E+05	3.55E+05
Phenanthrene	5.78E-01	NTF	NTF	NTF

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from five borings at the West Car Dismantle Area.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

(6) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-21

COMPARISON OF SITE CONCENTRATIONS AT THE PAINT BARREL PITS TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Antimony	4.80E+02	1.24E+03	2.82E+03	4.73E+03
Arsenic	**3.10E+01**	**1.77E+01**	**1.13E+01**	4.73E+02
Cadmium	1.50E+00	3.10E+03	7.05E+03	1.18E+04
Chromium	3.40E+01	1.55E+04	3.23E+03	2.52E+05
Copper	9.30E+02	1.15E+05	2.61E+05	4.38E+05
Lead(5)	**7.80E+03**	**1.00E+03**	**1.00E+03**	**1.00E+03**
Selenium	1.30E+01	1.55E+04	3.52E+04	5.91E+04
Thallium	1.10E+01	2.17E+02	4.93E+02	8.28E+02
Semivolatiles				
Phenol	6.80E-01	1.86E+06	4.23E+06	7.10E+06
2-Methylphenol	5.80E-01	1.55E+05	3.52E+05	5.91E+05
4-Methylphenol	1.70E+00	1.55E+04	3.52E+04	5.91E+04
2,4-Dimethylphenol	2.70E+00	6.20E+04	1.41E+05	2.37E+05
Anthracene	2.10E+01	9.31E+05	2.11E+06	3.55E+06
Pyrene	5.50E+01	9.31E+04	2.11E+05	3.55E+05
Naphthalene	2.20E+01	1.24E+05	2.82E+05	4.73E+05
Acenaphthylene	6.10E+01	NTF	NTF	NTF
Acenaphthene	7.70E+00	1.86E+05	4.23E+05	7.10E+05
Dibenzofuran	1.00E+01	NTF	NTF	NTF
Flourene	1.70E+01	1.24E+05	2.82E+05	4.73E+05
Phenanthrene	7.00E+01	NTF	NTF	NTF
Fluoranthene	7.10E+01	1.24E+05	2.82E+05	4.73E+05
Benzo(a)anthracene	**2.50E+01**	3.12E+01	**2.16E+01**	8.44E+02
Chrysene	2.40E+01	1.03E+03	7.15E+01	2.79E+04
Benzo(b)fluoranthene	1.90E+01	3.24E+01	2.24E+01	8.77E+02
Benzo(k)fluoranthene	1.40E+01	8.27E+01	5.72E+01	2.24E+03
Benzo(a)pyrene	**2.00E+01**	**4.53E+00**	**3.14E+00**	1.22E+02
Indeno(1,2,3-cd)pyrene	4.80E+00	1.96E+01	1.35E+01	5.29E+02
Dibenzo(a,h)anthracene	5.00E-01	4.08E+00	2.83E+00	1.10E+02
Benzo(g,h,i)perylene	4.30E+00	NTF	NTF	NTF
2-Methylnaphthalene	9.00E+00	NTF	NTF	NTF

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from seven borings at the Paint Barrel Pits.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) EPA recommends an acceptable range of 500-1000 mg/kg lead in residential soil (EPA 1989) .

TABLE 3-22

COMPARISON OF SITE CONCENTRATIONS AT THE CAR SHOP TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Cadmium	3.60E+00	3.10E+03	7.05E+03	1.18E+04
Silver	1.50E+00	1.55E+04	3.52E+04	5.91E+04

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) A composite sample was collected from one boring at the Car Shop.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-23

COMPARISON OF SITE CONCENTRATIONS AT THE STEEL SHOP TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Cadmium	5.00E-01	3.10E+03	7.05E+03	1.18E+04
Copper	1.24E+02	1.15E+05	2.61E+05	4.38E+05
Pesticides/PCBs				
alpha-BHC	1.20E+00	NTF	NTF	NTF
beta-BHC(5)	3.35E+00	1.72E+01	1.10E+01	4.60E+02
delta-BHC(6)	5.74E+00	NTF	NTF	NTF
gamma-BHC	2.28E+00	2.39E+01	1.52E+01	6.37E+02
Heptachlor(5)	3.35E+00	6.89E+00	4.38E+00	1.84E+02
Aldrin(6)	**5.74E+00**	**1.80E+00**	**1.16E+00**	4.87E+01
Dieldrin	**2.00E+00**	**1.94E+00**	**1.23E+00**	5.17E+01
Chlordane	6.28E+00	2.39E+01	1.52E+01	6.37E+02
Aroclor 1221	**8.07E+00**	**4.03E+00**	**2.56E+00**	1.08E+02
Aroclor 1016	**2.73E+00**	4.03E+00	**2.56E+00**	1.08E+02
Semivolatiles				
Anthracene	3.91E-01	9.31E+05	2.11E+06	3.55E+06
Pyrene	1.58E+00	9.31E+04	2.11E+05	3.55E+05
Naphthalene	2.71E+00	1.24E+05	2.82E+05	4.73E+05
Phenanthrene	2.00E+00	NTF	NTF	NTF
Benzo(a)anthracene	1.32E+00	3.12E+01	2.16E+01	8.44E+02
Benzo(k)fluoranthene	9.54E-01	8.27E+01	5.72E+01	2.24E+03
Benzo(a)pyrene	1.05E+00	4.53E+00	3.14E+00	1.22E+02
Indeno(1,2,3-cd)pyrene	7.62E-01	1.96E+01	1.35E+01	5.29E+02
2-Methylnaphthalene	7.23E+00	NTF	NTF	NTF

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from one boring at the Steel Shop.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

(6) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-24

COMPARISON OF SITE CONCENTRATIONS AT THE CAR HOLDING AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Cadmium	4.00E-01	3.10E+03	7.05E+03	1.18E+04
Copper	1.25E+02	1.15E+05	2.61E+05	4.38E+05
Zinc	5.59E+02	9.31E+05	2.11E+06	3.55E+06
Pesticides/PCBs				
beta-BHC(5)	3.43E-01	1.72E+01	1.10E+01	4.60E+02
delta-BHC(6)	6.10E-02	NTF	NTF	NTF
Heptachlor(5)	3.43E-01	6.89E+00	4.38E+00	1.84E+02
Aldrin(6)	6.10E-02	1.82E+00	1.16E+00	4.87E+01
Dieldrin	6.60E-02	1.94E+00	1.23E+00	5.17E+01
Heptaclor epoxide	2.70E-02	3.41E+00	2.17E+00	9.10E+01
4,4'DDT	2.10E-02	9.12E+01	5.80E+01	2.44E+03
4,4'DDE	8.40E-02	9.12E+01	5.80E+01	2.44E+03
Endosulfan I	6.90E-02	NTF	NTF	NTF
Chlordane	1.21E-01	2.39E+01	1.52E+01	6.37E+02
Aroclor 1242	2.18E-01	4.03E+00	2.56E+00	1.08E+02
Semivolatiles				
Phenanthrene	2.52E-02	NTF	NTF	NTF
Di-n-butylphthalate	3.00E-01	3.10E+05	7.05E+05	1.18E+06

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from three borings at the Car Holding area.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

(6) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-25

COMPARISON OF SITE CONCENTRATIONS AT THE CAR DEMOLISH AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Chromium	4.10E+01	1.55E+04	3.23E+03	2.52E+05
Mercury	5.00E-01	9.31E+02	2.11E+03	3.55E+03
Selenium	5.90E+00	1.55E+04	3.52E+04	5.91E+04
Pesticides/PCBs				
alpha-BHC	1.49E-04	NTF	NTF	NTF
beta-BHC(5)	8.52E-01	1.72E+01	1.10E+01	4.60E+02
delta-BHC(6)	1.53E+00	NTF	NTF	NTF
Heptachlor(5)	8.52E-01	6.89E+01	4.38E+00	1.84E+02
Aldrin(6)	**1.53E+00**	1.82E+00	**1.16E+00**	4.87E+01
Dieldrin	7.30E-02	1.94E+00	1.23E+00	5.17E+01
Heptaclor epoxide	7.20E-02	3.41E+00	2.17E+00	9.10E+01
4,4'DDE	5.20E-02	9.12E+01	5.80E+01	2.44E+03
Endosulfan I	5.51E-01	NTF	NTF	NTF
Endosulfan II	3.60E-02	NTF	NTF	NTF
Semivolatiles				
Di-n-butylphthalate	2.13E+02	3.10E+05	7.05E+05	1.18E+06

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from one boring at the Car Demolish area.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

(6) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-26

COMPARISON OF SITE CONCENTRATIONS AT THE SOUTH OPEN DRUM STORAGE AREA TO RBCs

	Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals					
	Silver	1.30E+00	1.55E+04	3.52E+04	5.91E+04
	Selenium	1.80E+00	1.55E+04	3.52E+04	5.91E+04
Pesticides/PCBs					
	Chlordane	1.66E-02	2.39E+01	1.52E+01	6.37E+02

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) A composite sample was collected from five borings at the open Drum Storage South area.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-27

COMPARISON OF SITE CONCENTRATIONS AT THE NORTH OPEN DRUM STORAGE AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Arsenic	**6.34E+01**	**1.77E+01**	**1.13E+01**	4.73E+02
Chromium	3.00E+01	1.55E+04	3.23E+03	2.52E+05
Copper	4.88E+02	1.15E+05	2.61E+05	4.38E+05
Lead(5)	**2.45E+03**	**1.00E+03**	**1.00E+03**	**1.00E+03**
Mercury	4.00E-01	9.31E+02	2.11E+03	3.55E+03
Silver	1.70E+00	1.55E+04	3.52E+04	5.91E+04
Selenium	4.30E+00	1.55E+04	3.52E+04	5.91E+04
Zinc	4.02E+03	9.31E+05	2.11E+06	3.55E+06
Pesticides/PCBs				
alpha-BHC	2.42E-01	NTF	NTF	NTF
delta-BHC(6)	3.45E+00	NTF	NTF	NTF
gamma-BHC	1.51E+00	2.39E+01	1.52E+01	6.37E+02
Aldrin(6)	**3.45E+00**	**1.82E+00**	**1.16E+00**	4.87E+01
Heptaclor epoxide	8.45E-02	3.41E+00	2.17E+00	9.10E+01
4,4'-DDT	3.24E-01	9.12E+01	5.80E+01	2.44E+03
4,4'-DDE	6.14E-02	9.12E+01	5.80E+01	2.44E+03
4,4'-DDD	6.81E-02	1.29E+02	8.22E+01	3.45E+03
Chlordane	1.16E-01	2.39E+01	1.52E+01	6.37E+02
Endosulfan II	4.51E-02	NTF	NTF	NTF

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from five borings at the open Drum Storage North area.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) EPA recommends acceptable range of 500-1000 mg/kg lead in residential soil (EPA 1989) .

(6) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-28

COMPARISON OF SITE CONCENTRATIONS AT THE EIGHTH STREET YARD (CENTRAL) TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Copper	1.12E+02	1.15E+05	2.61E+05	4.38E+05
Silver	1.40E+00	1.55E+04	3.52E+04	5.91E+04
Zinc	5.75E+02	9.31E+05	2.11E+06	3.55E+06
Pesticides/PCBs				
alpha-BHC	1.80E-02	NTF	NTF	NTF
delta-BHC(5)	3.79E+00	NTF	NTF	NTF
gamma-BHC	7.18E-01	2.39E+01	1.52E+01	6.37E+02
Aldrin(5)	**3.79E+00**	**1.82E+00**	**1.16E+00**	4.87E+01
Dieldrin	8.77E-01	1.94E+00	1.23E+00	5.17E+01
4,4'-DDE	1.59E+00	9.12E+01	5.80E+01	2.44E+03
4,4'-DDD	2.80E-02	1.29E+02	8.22E+01	3.45E+03
Chlordane	1.74E+00	2.39E+01	1.52E+01	6.37E+02
Aroclor 1248	8.98E-01	4.03E+00	2.56E+00	1.08E+02
Semivolatiles				
Benzo(a)anthracene	1.14E+00	3.12E+01	2.16E+01	8.44E+02

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from four borings at the 8th Street Yard (Central) .

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-29

COMPARISON OF SITE CONCENTRATIONS AT THE EIGHTH STREET YARD (NORTH) TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Arsenic	**2.15E+02**	**1.77E+01**	**1.13E+01**	4.73E+02
Cadmium	5.00E-01	3.10E+03	7.05E+03	1.18E+04
Copper	7.30E+02	1.15E+05	2.61E+05	4.38E+05
Lead(5)	4.03E+02	1.00E+03	1.00E+03	1.00E+03
Mercury	4.00E-01	9.31E+02	2.11E+03	3.55E+03
Silver	9.70E+00	1.55E+04	3.52E+04	5.91E+04
Selenium	3.60E+00	1.55E+04	3.52E+04	5.91E+04
Zinc	1.03E+03	9.31E+05	2.11E+06	3.55E+06
Pesticides/PCBs				
alpha-BHC	1.41E+00	NTF	NTF	NTF
beta-BHC(7)	4.51E+00	1.72E+01	1.10E+01	4.60E+02
delta-BHC(6)	6.07E+00	NTF	NTF	NTF
gamma-BHC	8.80E-01	2.39E+01	1.52E+01	6.37E+02
Aldrin(6)	**6.07E+00**	**1.82E+00**	**1.16E+00**	4.87E+01
Dieldrin	**3.30E+00**	**1.94E+00**	**1.23E+00**	5.17E+01
Heptaclor epoxide(7)	**4.51E+00**	**3.41E+00**	**2.17E+00**	9.10E+01
4,4'-DDT	1.83E-01	9.12E+01	5.80E+01	2.44E+03
4,4'-DDE	1.69E+00	9.12E+01	5.80E+01	2.44E+03
4,4'-DDD	1.04E-01	1.29E+02	8.22E+01	3.45E+03
Chlordane	3.98E+00	2.39E+01	1.52E+01	6.37E+02
Aroclor 1254	5.87E-01	4.03E+00	2.56E+00	1.08E+02
Semivolatiles				
Anthracene	3.65E-01	9.31E+05	2.11E+06	3.55E+06
Pyrene	5.04E-01	9.31E+04	2.11E+05	3.55E+05
Phenanthrene	3.45E-01	NTF	NTF	NTF
Di-n-butylphthalate	3.92E-01	3.10E+05	7.05E+05	1.18E+06

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from six borings at the 8th Street Yard (North) .

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) EPA recommends an acceptable range of 500-1000 mg/kg lead in residential soil (EPA 1989) .

(6) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

(7) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-30

COMPARISON OF SITE CONCENTRATIONS AT THE EIGHTH STREET YARD (SOUTH) TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Arsenic	**4.19E+02**	**1.77E+01**	**1.13E+01**	4.73E+02
Cadmium	7.00E-01	3.10E+03	7.05E+03	1.18E+04
Copper	6.05E+02	1.15E+05	2.61E+05	4.38E+05
Lead(5)	9.94E+02	1.00E+03	1.00E+03	1.00E+03
Mercury	4.00E-01	9.31E+02	2.11E+03	3.55E+03
Silver	9.80E+00	1.55E+04	3.52E+04	5.91E+04
Selenium	2.90E+00	1.55E+04	3.52E+04	5.91E+04
Zinc	3.54E+03	9.31E+05	2.11E+06	3.55E+06
Pesticides/PCBs				
beta-BHC(7)	7.13E-01	1.72E+01	1.10E+01	4.60E+02
delta-BHC(6)	7.45E-01	NTF	NTF	NTF
gamma-BHC	7.15E-01	2.39E+01	1.52E+01	6.37E+02
Aldrin(6)	7.45E-01	1.82E+00	1.16E+01	4.87E+01
Heptaclor epoxide(7)	7.13E-01	3.41E+00	2.17E+00	9.10E+01
4,4'DDT	2.18E-02	9.12E+01	5.80E+01	2.44E+03
4,4'-DDD	3.34E-02	1.29E+02	8.22E+01	3.45E+03
Endosulfan I	4.06E-02	NTF	NTF	NTF
Endrin	3.34E-02	9.31E+02	2.11E+03	3.55E+03
Endosulfan II	5.80E-02	NTF	NTF	NTF
Chlordane	1.74E+00	2.39E+01	1.52E+01	6.37E+02
Aroclor 1248	8.98E-01	4.03E+00	2.56E+00	1.08E+02
Semivolatiles				
Phenanthrene	1.19E+00	NTF	NTF	NTF

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from four borings at the 8th Street Yard (South) .

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) EPA recommends an acceptable range of 500-1000 mg/kg lead in residential soil (EPA 1989) .

(6) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

(7) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-31

COMPARISON OF SITE CONCENTRATIONS AT THE GRACE STREET YARD TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Copper	6.65E+01	1.15E+05	2.61E+05	4.38E+05
Selenium	2.70E+00	1.55E+04	3.52E+04	5.91E+04
Pesticides/PCBs				
alpha-BHC	6.05E-02	NTF	NTF	NTF
gamma-BHC(5)	3.58E-02	2.39E+01	1.52E+01	6.37E+02
Aldrin(5)	3.58E-02	1.82E+00	1.16E+00	4.87E+01
Dieldrin	2.26E-02	1.94E+00	1.23E+00	5.17E+01
Endosulfan Sulfate	2.10E-02	NTF	NTF	NTF
Semivolatiles				
Pyrene	1.04E+00	9.31E+04	2.11E+05	3.55E+05
Acenaphthene	4.61E-01	1.86E+05	4.23E+05	7.10E+05
Phenanthrene	1.21E+00	NTF	NTF	NTF
Benzo(a)anthracene	3.68E-01	3.12E+01	2.16E+01	8.44E+02
Chrysene	4.17E-01	1.03E+03	7.15E+02	2.79E+04
Benzo(k)fluoranthene	3.33E-01	8.27E+01	5.72E+01	2.24E+03
Benzo(a)pyrene	4.24E-01	4.53E+00	3.14E+00	1.22E+02
2-Methylnaphthalene	1.34E+00	NTF	NTF	NTF

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) A composite sample was collected from four borings at the Grace Street Yard.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) These compounds co-eluted. Concentration given is the total for one or both of the compounds. If both compounds are present, the percentages of each are unknown.

TABLE 3-32

COMPARISON OF SITE CONCENTRATIONS AT THE GRACE STREET TANK TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
TPH (as Diesel)	1.30E+04	2.48E+04	5.64E+04	9.46E+04

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) A composite sample was collected from four boreholes at the Grace Street Tank.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-33

COMPARISON OF SITE CONCENTRATIONS AT THE OIL PIPELINE TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
TPH (as #2 Fuel Oil)	4.40E+03	2.48E+04	5.64E+04	9.46E+04

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

(1) The site concentration represents the maximum concentration of the samples from 9 boreholes at the Oil Pipeline.

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

TABLE 3-34
COMPARISON OF SITE CONCENTRATIONS AT THE CONSTRUCTION AREA TO RBCs

Analyte	Site Concentration (1)	RBC Recreational(2)	RBC Occupational(3)	RBC Construction(4)
Metals				
Arsenic	**3.00E+02**	**1.77E+01**	**1.13E+01**	4.73E+02
Barium	8.00E+02	2.14E+05	4.59E+05	7.96E+05
Berylllium	2.40E+00	7.21E+00	4.59E+00	1.93E+02
Cadmium	1.90E+01	3.10E+03	7.05E+03	1.18E+04
Chromium	5.90E+01	**1.55E+00**	3.23E+03	2.52E+05
Copper	4.00E+02	1.15E+05	2.61E+05	4.38E+05
Lead(5)	**1.80E+03**	**1.00E+03**	**1.00E+03**	**1.00E+03**
Silver	9.70E+00	1.55E+04	3.52E+04	5.91E+04
Selenium	5.60E+00	1.55E+04	3.52E+04	5.91E+04
Volatiles				
Methylene chloride	1.50E-02	5.42E+01	7.58E+00	5.91E+02
Toluene	2.00E-03	1.49E+04	7.50E+03	2.33E+04
Tetrachloroethene	2.00E-03	40.1E+01	5.84E+01	4.51E+03
Pesticides/PCBs				
alpha-BHC	4.40E-01	NTF	NTF	NTF
delta-BHC(6)	3.60E-03	NTF	NTF	NTF
Heptachlor	8.80E-03	6.89E+00	4.38E+00	1.84E+02
Aldrin(6)	9.50E-03	1.82E+00	1.16E+00	4.87E+01
Heptaclor epoxide	1.70E-02	3.41E+00	2.17E+00	9.10E+01
4,4'-DDT	1.20E-02	9.12E+01	5.80E+01	2.44E+03
4,4'-DDE	2.80E-02	9.12E+01	5.80E+01	2.44E+03
4,4'-DDD	1.80E-02	1.29E+02	8.22E+01	3.45E+03
Endosulfan Sulfate	4.60E-03	NTF	NTF	NTF
Endrin Aldehyde	4.40E-03	NTF	NTF	NTF
Methoxychlor	1.80E-02	1.55E+04	3.52E+04	5.91E+04
Chlordane	3.80E-01	2.39E+01	1.52E+01	6.37E+02
Semivolatiles				
Acenapththene	6.00E-03	1.86E+05	4.23E+05	7.10E+05
Di-n-butylphthalate	1.70E-02	3.10E+05	7.05E+05	1.18E+06
Fluorene	5.00E-03	1.24E+05	2.82E+05	4.73E+05
Fluoranthene	9.70E-03	1.24E+05	2.82E+05	4.73E+05
Phenanthrene	3.60E-02	NTF	NTF	NTF
Anthracene	5.30E-03	9.31E+05	2.11E+06	3.55E+06
Benzo(a)anthracene	5.20E-03	3.12E+01	2.16E+01	8.44E+02
Benzo(a)pyrene	5.30E-03	4.53E+00	3.14E+00	1.22E+02
Benzo(b)fluoranthene	5.70E-03	3.24E+01	2.24E+01	8.77E+02
Benzo(k)fluoranthene	4.60E-03	8.27E+01	5.72E+01	2.24E+03
Chrysene	5.30E-03	1.03E+03	7.15E+02	2.79E+04
Di-n-octylphthalate	3.60E-03	6.20E+04	1.41E+05	2.37E+05
Pyrene	9.90E-03	9.31E+04	2.11E+05	3.55E+05
N-Nitrosodiphenylamine	2.30E-02	6.33E+03	4.03E+03	1.69E+05
Benzo(g,h,i)perylene	4.50E-03	NTF	NTF	NTF
N-Nitrosodi-n-propylamine	3.80E-02	4.43E+00	2.82E+00	1.18E+02

All concentrations are in mg/kg.

Shaded areas denote RBCs which were exceeded by the site concentration.

NTF = No EPA established toxicity factor

(1) The site concentration represents the maximum concentration found in samples collected at the 19 borings in the Construction Area

(2) RBC: Risk-based concentrations based on recreational exposures.

(3) RBC: Risk-based concentrations based on occupational exposures.

(4) RBC: Risk-based concentrations based on construction exposures.

(5) EPA recommends acceptable range of 500-1000 mg/kg lead in residential soil (EPA 1989) .

(6) These compounds co-eluted concentration given is the total for one or both of the compounds. If both compounds are present, the precentages of each are unknown.

4.0
SUMMARY AND CONCLUSIONS

The purpose of this "screening-level" risk assessment was to determine if chemicals in soils at the UPRR Omaha Shops and Maintenance Facility are present at concentrations that could pose potential human health risks. The risk assessment was completed by comparing concentrations detected in soils at the site with conservative RBCs. For this evaluation, RBCs were calculated for occupational workers, construction workers, and child recreational receptors based on very conservative assumptions of exposure and target risk levels. Actual exposures to contaminants at the sites are expected to be much lower. Metals which were determined to be above critical background values and any detected organic compounds were compared to the RBCs.

Fourteen of the Omaha Shops sites had chemical concentrations which exceeded one or more RBCs. The Oil Storage, Wastewater Treatment/Babbitt Shop, Blue Building, Acetylene Pit, Power House, Hazardous Waste Storage, Paint Barrel Pits, Steel Shop, Car Demolish, Traction Motor Shop, and Open Drum Storage (north) sites had concentrations that exceeded RBCs by less than an order of magnitude for all scenarios. Therefore, significant human health risks from exposure to soil would not be expected at these sites.

At the north area of the Eighth Street Yard, arsenic concentrations exceeded the recreational and occupational RBCs by factors of 12 and 19 times, respectively. At the south area of the Eighth Street Yard, arsenic concentrations exceeded the recreational and occupational RBCs by factors of 24 and 37 times, respectively. At the Construction Area, arsenic concentrations exceeded the RBC by a factor of about 25. However, the estimated lifetime excess cancer risk associated with these arsenic concentrations, based on comparison to RBCs, is within the EPA's target risk range of 1×10^{-6} to 1×10^{-4} (1 in 1,000,000 to 1 in 10,000) for exposures to chemicals released from hazardous waste sites (EPA 1991d). Therefore, considering that actual recreational or occupational exposures to contaminated soil would be much lower than those assumed for the RBCs, significant human health risks would not be expected at these sites.

At the Storage Tank Area near the Blue Building, PCE concentrations exceeded the occupational RBC by a factor of about 700. This concentration may be high enough to warrant further evaluation of the site; however, since earlier efforts to confirm the presence of PCE in the soil at this area failed to detect PCE, the high PCE concentration detected is highly suspect.

Since only three of the thirty-one sites had detected concentrations that exceeded RBCs by more than a factor of 10, it can be concluded that the vast majority of the Omaha Shops and Maintenance Facility area poses very little potential for human health risks. However, three of the areas have localized contamination at concentrations that may warrant further evaluation.

5.0
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